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ROYAL BOTANIC GARDENS, SYDNEY

National Herbarium of New South Wales

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Contributions from the National Herbarium of New South Wales

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This issue is dedicated to the memory of

JOYCE WINIFRED VICKERY

1908–1979

FOREWORD

This issue of Telopea is dedicated to the memory of Dr Joyce Winifred Vickery, M.B.E., who died on 29th May, 1979, after a short illness. Mrs Alma Lee, a colleague and friend since undergraduate days, writes warmly and informatively of Dr Vickery's life and work. It is left for me to express the widely felt appreciation of this fine woman and notable botanist, and the sense of loss experienced by Australian botanists, particularly by her colleagues at the National Herbarium of New South Wales.

Joyce Vickery came to this institution in its dark days, at the end of the Great Depression of the 1930's, when the Herbarium and the Sydney Botanic Gardens had languished for more than a decade after the retirement of J. H. Maiden. Immediately, she began to raise scientific standards through her own studies and by her influence on others, but soon the Second World War intervened. In the post-war period the Chief Botanist and Curator, R. H. Anderson, had Joyce as his strong right arm, encouraging him to resume the painfully slow process of building a research institution that paid some attention to what had happened in botany over the preceding 20 years, and what was happening currently.

New staff members with relevant though varied scientific backgrounds were appointed. They had to learn how taxonomy was actually done from Joyce Vickery or from others whom she had trained—certainly in those days they received no useful education in the subject at Australian universities.

A precise and methodical worker in alpha-taxonomy, Joyce, in her lifelong studies of the grasses, concentrated on discrimination of species, provision of full and accurate descriptions, and construction of practical keys. She did not develop any deep interest in theory or in new technical approaches. Generic concepts were of less interest to her, and suprageneric relationships she largely left to others. She was a close observer of variation, and was conscious of population characteristics in the field. This is evident especially in her work on subalpine and alpine species of *Poa*. Her conservative approach did not prevent her, especially in the 1940's and 50's, from encouraging colleagues who had interests in theoretical taxonomy. All her associates acknowledged Joyce as a patient and reliable guide on matters of nomenclature and clarity of expression, and they owed much to her as a dispenser of wisdom in personal relations.

At a time when conservation of natural communities and landscapes received little sympathy from governments, the media, or the populace, Joyce lent her efforts to this cause, especially at Kosciusko and in the bushlands near Sydney. Though quietly done, her work was effective both through direct involvement and by stimulating a scientific approach to the principles of conservation.

The scope of Joyce Vickery's solid contribution to Australian grass systematics is evident from the bibliography on page 8. After retirement, appointment as an Honorary Research Fellow recognized her past and continuing research. During these years she completed a second substantial part of the Poaceae (Gramineae) for the Flora of New South Wales and, until her last illness took away her strength, she worked steadily on the revision of *Stipa* in Australia. Her manuscript descriptions and notes on this genus are being worked up for publication by Dr Surrey Jacobs, aided by Ms Joy Everett.

In the years following her retirement, Joyce Vickery withdrew almost entirely from the life of the Herbarium as a whole, preferring to remain in the Annexe across the lawns of the Upper Garden, into which the Herbarium and some of its workers were compelled to spill over by lack of space for growth.

The less restrained atmosphere, new styles and topics of conversation, and perhaps some of the different technical and theoretical approaches to investigation were, I believe, not to her taste. Nor were the changes associated with modernization of the Herbarium publications, or the decision not to maintain the Flora of New South Wales program in its original form. Nevertheless, she was always ready to extend the benefit of her experience to those who sought it.

Sadly, Joyce did not live to see construction begin on the new Herbarium building. She had laboured mightily to assist the architects with planning for the earlier project in the 1960's and, although the plan finally adopted differed greatly, a number of its features grew out of the earlier concept. Feeling, it seems, that the Herbarium as an institution had passed into a new phase, she did not display great interest in the new plans, but concentrated her still remarkable energies on a very different project, the development and promotion of the Sydney Science Centre. Those of us who did not share her conviction of the scientific value of that troubled enterprise regretted finding themselves in opposition, on that point, to one whom they sincerely respected as a person and a scientist.

Joyce Vickery's lasting contribution to science was firstly to provide stimulus and guidance in the renascence of botanical taxonomy in New South Wales, and indeed in Australia, and equally to resolve and clarify with great skill the systematics of many groups of Australian grasses. For those things, and for her understanding and her integrity, we honour her in this issue.

L. A. S. Johnson,
Director,
Royal Botanic Gardens.

JOYCE W. VICKERY
1908–1979

Joyce Winifred Vickery

1908–1979

Looking back over nearly fifty years of acquaintance with this unassuming and reserved woman, one comes to recognize at every turn how early was the pattern established for her later life. For there were few among her friends at the end of her life who did not remember her for her strength and support, in one facet or another of their lives, from the earliest days of their association. Though just emerging into adulthood when she entered the University of Sydney in 1927, she already evinced the independence of thought and action which lay beneath a gentle and reticent demeanour. Never forward or self-seeking in the progress of her career, she was nevertheless zealous and resolute in achieving the goals which she set herself. In her particular situation it would have been easy to drift along on natural ability to some undemanding occupation, since private means removed all need for self support. But to Joyce Vickery this would have been reprehensible and quite inadmissible, and two resolves were made early, and maintained. In quite early childhood she had hotly declared to her family that she would never marry—she 'didn't want any man hanging on to *her* coat tails'—and though she saw the humour of that situation later on, she certainly stuck to her feminist guns throughout life! (To her, men could claim superiority only by proof of achievement, never by assuming the kingship of a man's world, and, especially in later years of Women's Liberation, women could claim equality only by proof of achievement!). Her other early resolve was to be self-supporting, and once embarked on her career she strove to live within her earned means, though always willing to put other capital to use for justifiable projects. She called it "lending her crowbar" to move other people's rocks—they got their job done, she got her crowbar back.

Much of this personality can be seen clearly in the two Australian generations of her family which preceded hers. It was the solid British instinct for progress by initiative which motivated her great-grandfather to seek a new life in Australia. Conditions in his birthplace, London, offered little opportunity for his young family, so 1833 saw them embarked upon the six months' sea voyage to Sydney, where their father recommenced his business in the leather trade. A son, Ebenezer, Joyce's grandfather, finished his education in 1843 (at 16) and gained experience in several enterprises before entering his father's business. An entry in "Australian Men of Mark, vol. 2, 1788–1888" describes Ebenezer Vickery as '. . . not rash in speech or act, never . . . gambling. (He) . . . added the habit of strict discipline and careful foresight; although a born speculator, he never speculated beyond his ability nor risked more than he could afford to lose. He found time for charitable and religious committees, assisting with money and active work . . . an upright merchant and liberal citizen'. This extract illustrates the standards set for the ensuing generations, including Joyce's immediate family, and though the development of independent thought meant for her the sloughing off of some of the ties which they imposed she never eschewed the ethics germane to those standards.

Her father, George B. Vickery, developed, it seems, very much in the pattern of his father; he showed the same self-discipline, the same independent initiatives, the same ethics. In particular, he developed an interest in the burgeoning science of the period. Self-taught, he established a procedure for himself which Joyce herself adopted: when she needed information on a subject new to her, she would search the bookshop shelves for the most authoritative textbook, and study that—grass roots sources were more to be trusted than those more derived. George Vickery's interest in science was more than superficial; he became an experienced "ecologist", an accomplished microscopist, and was elected to the Royal Society of New South Wales in a period when qualifications for election were demanding. His interest in grassland ecology developed from his father's delegation to him of responsibility for the pastoral properties in which he had invested, and this had direct implications for Joyce, as later developments showed. His capacities were manifested also in Joyce's two brothers, both of whom graduated in Engineering

(University of Sydney) though one found greater satisfaction later in the development of a rural property.

But this capacity in physical and mechanical skills could have derived also from their mother's side of the family. Joyce's maternal grandfather also had migrated to Australia, and of his family of five, all four sons were to become engineers. German by birth, Ottomar Rossbach arrived in Australia in 1850 and worked as an engineer in the equivalent of our Public Works Department. It is of particular interest in our present context, that one of his construction projects was the sandstone sea-wall around Farm Cove, in the Royal Botanic Gardens. His sons continued in similar work connected with Water Supply, Harbours and Rivers. Those of us who had experienced the weight of the substantial leather handbag which Joyce always carried, knew it was occasioned largely by the contents: it was "par for the course" to include, as well as essential papers and minimal cosmetic requirements, anything from oil can to basic plumbers' tools! If Joyce had been born male, it is a certainty that she too would have found her vocation in some aspect of engineering!

This, then, was Joyce Vickery's inheritance, with its principles of initiative, self-discipline and devotion to duty, in a comfortable environment of liberal means (and a sense of its obligations).

It was the family's misfortune to lose their mother when Joyce, youngest of the four children, was in her fourteenth year. But she, particularly, had inherited at least her share of rugged self-sufficiency and this came to her aid in the survival strategies which inevitably operate in such a situation. As the youngest sibling, she learnt from the experience of her elders; she recognized the potential of her position in a family headed by a serious, firm but always just and adequate provider, though one not always of the same persuasions as herself. One wonders, if, in this period, her father was not equally developing an awareness, tempered by amusement, of the potential of his younger daughter! While always holding her father in high and affectionate regard, Joyce turned often for guidance to her brother Otto, for his help in practical matters was effective, and his advice, if not favourable to her *desiderata*, could be disregarded without offence!

It was in her schooldays that Joyce's developing interests and enthusiasms first showed confluence with those of her father. The overseeing of his father's rural properties entailed a good deal of motor travel in both New South Wales and Queensland, and finding the experience enjoyable to them both, he often took Joyce with him, camping out where possible, and so she was an unusually early participant in what has become a favourite Australian pastime—the family camping holiday. Joyce learned much from her father's grassland experience, and she came to draw confidence and satisfaction from travel off the beaten track before she ever applied her experience to professional botany and ecology.

So, full of vigour (she was a more than adequate tennis player in her schooldays) and enthusiasm, Joyce Vickery, undergraduate, enrolled in Science I (1927) at the University of Sydney. In her major subjects, Edgeworth David was nearing the end of an inspiring leadership of the Geology Department, and in Botany the newly arrived, young and enthusiastic T. G. B. Osborn was embarking upon a programme of revitalization. His course was now dynamic, and the Botany and Zoology (W. J. Dakin) Schools had each at their head men with oratorical gifts, and we loved it! The scope of these subjects also was still restricted enough for a few gifted individuals to encompass sufficient of each to relate them intimately, and so to explain puzzling natural phenomena.

A Science Society was already in existence, but now a Biological Society was constituted, providing a forum for discussion of aspects of Botany and Zoology then occupying the minds of students. At lunch hour addresses much time and energy was expended, *inter alia*, in reaching a "conclusive definition of a species"

Taxonomy, or Systematics, like other aspects of the discipline, was just beginning to emerge as a living subject and this matter was important to us. But in the midst of all manner of carefully worded "definitions", Joyce found her answer in the much-quoted saying that a species is what a good systematist calls a species, and so it was to Joyce throughout her working life on botanical taxa and their hierarchies. Perhaps, as a result of this, she missed something in the upsurge of interest in speciation processes which took place as she finished her University studies, but her conservatism and rationality led her always to contemplate new enthusiasms for the solution of species definition with tolerance, even forbearance, while herself anticipating that *only* morphology would serve our purposes in the end!

The Biological Society was effective in the promotion of field work too, and Professor Osborn's Department was supplemented by the Society's Hut on Narrabeen Heights. This simple structure, erected by the students themselves on a gift of land, provided a permanent "camp" for the collection and identification of native plants (required work in senior years), as well as an informal meeting ground for male and female students, who had usually been rigidly segregated in city schools, in a society very different from today's. In this period Joyce, a senior student and (after graduation in 1931) Demonstrator and Research Student in the Botany Department, was much influenced by her colleague Lilian Fraser, her greatly admired senior by one year, and together they made an important contribution to the success of the Hut and to the practice of field work which grew out of such beginnings. The acquisition of a second-hand, 1926 Chevrolet tourer, in shared ownership, about 1931, set the stage for a long period of working-holiday ecological studies, collecting trips and photographic forays which occupied their annual leave and leisure periods for many years. Approved juniors were added to the party, or appropriate colleagues for specialist trips in later years, and many students or young graduates of the period will remember with lasting pleasure, working holidays in "Enoch Arden" (the Chev.), setting off with Joyce at the wheel of her trusty chariot, whether to Bulli Pass for the day, Barrington Tops for a week, or on an exploratory tour over the roads of coast and tablelands. We ourselves recognize that Joyce made much of it possible in those days of economic difficulty—for her university period was in the depths of The Depression—and still rejoice in our extreme good fortune to have seen so much of this country at that time. Roads were not then hazardous, delightful campsites awaited us at the end of each day, and pollution and exploitation had not yet begun to ravage the land. Joyce herself enjoyed it all enormously, and little signs of delight would sometimes allow it to be known, though she was not given to much demonstration. On the other hand, she shouldered full responsibility for the vehicle and its performance, and this weighed heavily upon her when her companions' frequently expressed wish to continue "just around the next corner" took her to the estimated limit of the car's or the party's capacity. Some alarm arose, during a trip to Barrington Tops, when an all-girl party was believed to be "lost in the snow"; ". . . *not* lost" said Joyce later "we knew exactly where we were . . .". She was once "led on" in the then very remote Mount Royal Ranges, so that fuel was exhausted many miles from any source of petrol. This time chance befriended the party, in the form of a young man teaching himself to drive, in absolute isolation, in a proud and ancient Dodge. He gave petrol, and in return, Joyce showed him how to set his car in motion, by releasing the handbrake! The results of several working visits to Barrington House on the Upper Williams River and thence to Barrington Tops, were later published in joint authorship with Lilian Fraser in three papers essentially on the ecology of the area. Having no precursors, or previous experience, with the rainforest species found there, identification of the many huge trees of the forest had to be done *de novo*, with confirmation later at the New South Wales National Herbarium. Collections made then, pressed and labelled round the fire at Barrington House, are now incorporated in that Herbarium.

After some five years of postgraduate work in the Botany School, during which she published early work on insectivorous plants, held presidency of the Biological Society, was elected to the Royal Society of New South Wales, and gained her M.Sc.

degree, Joyce achieved her ambition of full professional employment. Towards the end of 1936, the retiring Botanist and Curator of the National Herbarium, Edwin Cheel, was to be succeeded by promotion of R. H. Anderson, the first graduate incumbent, young and eager to effect some professional rejuvenation of this somewhat musty, if venerable, branch of the Department of Agriculture. Joyce's appointment in August 1936 was as Assistant Botanist, and even greater than personal satisfaction in her achievement, was gratification at having broken the sexist barrier for the first time in the Professional Division of that Department. She had also won a minor battle of standards, by refusing to accept the starting salary of £188 p.a. for a female officer (it was later settled, on the basis of qualifications, at £251 p.a.!).

The appointment of these two graduate officers was a happy conjunction for the Herbarium, Anderson's whimsical humour and commonsense attitudes making it possible for him to appreciate fully his new and energetic staff member, while Joyce for her part, encountering no sexist discrimination, responded as fully. Her position was indeed a novel one; as the first woman ever appointed a professional officer in a scientific capacity in the Public Service, she was determined to succeed, not only in her Botany, but in her personal relations as well, for there was still considerable opposition in the Service to the idea of professional female employees. It is impossible to separate Anderson's contributions from Joyce's to the Herbarium in those years when both worked hard for its improvement, but it is fair to surmise that often the idea was hers, the implementation his, for he took a confessed and impish delight in cutting red tape.

In this period, the Herbarium's function as the Botany Branch of the Department of Agriculture was primarily the identification of material submitted by agronomists, and those concerned with weeds legislation or with poisonous plants. Taxonomic research, after an early period of notable achievement, had over some years receded into a poor second place, no longer recognized as a basic prerequisite for the other services. To Joyce, as an inexperienced recruit, the routine work brought a daily challenge in providing accurate responses to enquiries, while there was time enough, and great freedom of choice, to develop initiatives in research.

The thoroughness and reliability of her own work came to set the standard for the gradually increasing staff, and for this reason one of Joyce's earliest innovations at the Herbarium takes on great significance. This was her application, after only about a year on the staff, for leave of absence in which she wished to experience a period of work at the Herbarium of the Royal Botanic Gardens at Kew—regarded as the source of all taxonomic wisdom (and Type specimens). With Anderson's support her application succeeded, but with minimal concessions from the Public Service Board; she was granted leave of absence for a year, salary for three months, and was bonded for three years after her return!

This year, most of it working at Kew, was of inestimable value in formulating future standards in Sydney, for Joyce shared her experience with other staff, and all those junior to her in later years will attest to her capacity as teacher, her sympathetic attitudes and generosity of effort. With the experience of work at Kew, among botanists of international repute with older traditions and much greater experience than obtained in Australia for many years afterwards, all that she transmitted here was soundly based and gave our staff a flying start in their professional careers.

On her return from Kew, Joyce found that Anderson's representations for improved Herbarium accommodation had received some recognition and that early plans had been drafted. She applied her overseas experience to achieving improved arrangements within the scope of those plans. This project, dear to Anderson's heart, has suffered many setbacks, but Joyce applied herself with great assiduity to the achievement of optimal internal detail when it again seemed a possibility under the next Director, H. K. C. Mair. It is sad that neither she nor Anderson is here to see, 43 years after its inception, the start of the new building.

After accommodation, the next major facility to attract her attention at the Herbarium was its library. She had learnt the value of adequate literature sources at Kew, and the lack of organization at Sydney was unbelievable. So, armed with a Dewey System manual and the impressed but willing labour of a junior colleague, she tackled the classification and re-arrangement of the bookcases and their contents. Even then a required volume could be traced only by way of this system, since indexing had long been neglected, and this deficiency was not redressed for several years.

Joyce was imbued, from the time of her appointment, with a strong sense of injustice at the discrimination practised against women in the matter of rates of pay, and it was not long before she began to play her part in seeking to end that discrimination. Submissions to the Public Service Board for equal pay were summarily rejected, but she returned to the fray with an appeal, supported by legal counsel, against the rejection. Counsel advised that there was not much hope of success, but governments paid lip-service to the principle, and her attempt bore fruit before (though not long before) the end of her career.

A few years after her appointment, Australia was embroiled in World War II, though the Herbarium staff suffered a reduction of only one as a result. Wartime conditions were not difficult for us, with slight variation in our work—such as the compilation of information on edible or poisonous native plants for special units of the Services. Joyce herself enrolled in, and persuaded other women to join, the National Emergency Services Ambulance Drivers, and extended this by setting up a branch depot at her home at Cheltenham. Not only was the usual First Aid training given, but a sound course in motor mechanics made it theoretically possible for the potential drivers to effect light repairs when on the job. There were some lighter sides to this occupation, but Joyce's attitude was, of course, serious and responsible. She also organized the recording, and despatch to safekeeping, of large numbers of Types and other specimens of special importance in the Herbarium. But the Sydney Botanic Gardens and Herbarium, apart from being close to the action when Japanese submarines made a brief attack on the nearby Garden Island Naval Base, were not seriously threatened and had suffered little change when the war ended.

It was perhaps fortunate that an early start had been made on another project undertaken by Anderson with Joyce's co-operation, and that it had already been established before the war began. This was a specialist publication adapted to the needs of taxonomic botanists. The existing Departmental production, the Agricultural Gazette, was unsuited for the purpose both in its character and its readership, so with Joyce as Editor, "Contributions from the New South Wales National Herbarium" first appeared in July 1939. Most of the other States, as well as the Commonwealth's Herbarium Australiense, have now followed this lead and have their own corresponding journals to provide for the considerable upsurge in taxonomic publication, after its decline in the earliest days of this century.

Later there followed the start on a new Flora of New South Wales, of which the first parts were issued as a "Flora Series" of the Contributions, for reasons of financial expediency. The first issue was an important one. The Rev. H. M. R. Rupp, a retired clergyman, had long devoted his leisure, and years of honorary work at the Herbarium, to the collection and study of native orchids. He had a completed manuscript ready for publication on Orchidaceae of New South Wales before the Flora Series had been approved, and this was an opportunity not to be missed. So with contributions from private citizens and members of the Orchid Society of New South Wales, Joyce anonymously financed publication of "The Orchids of New South Wales" in a format which could later serve as a first part of the new State Flora.

Joyce rendered great service in this phase of our publications, both in the physical work of editing, and by sharing her gift for lucid expression with those whose work she edited. She went about this work with studied diplomacy, sometimes feeling it necessary almost to rewrite another's work (if the deficiency was only in composition),

yet did this without offending. She sought criticism of her own writing from colleagues and soon formulated a plan for taxonomic publication which she then used consistently, because it satisfied all her requirements. For this reason she was inclined to be impatient with suggested improvements in format and expression in later years, but after retirement she firmly abstained from any part in decision-making, and never pressed her views. Her consistent presentation of thorough research, based on careful observations and the assumption that "if there is a difference it will show", built up for her an excellent reputation by world standards, because essentially it is practical. Her revision of the genus *Poa* in Australia, a group widely known as a taxonomic headache, brought letters of acclaim from overseas as well as Australian colleagues—those who understood that difficult groups inevitably require a degree of esoteric distinction between their constituents which only long study can detect and great persistence of effort can express. This skill in apt expression has often found an outlet in lighter vein: she once expostulated at the over-effusive gratitude (for some minor kindness) of a younger colleague, who persisted that "politeness is said to grease the wheels of civilisation." The prompt retort was "Yes, but there's such a thing as slopping the oil around". One wonders sometimes at this easy turn of phrase, for Joyce had no literary pretensions and in adult life read almost nothing beyond "whodunits" and a few popular science/romance series, but the authors she preferred, and whose titles she sought to exhaustion, were those with a certain elegance of expression.

Joyce's work on grasses had begun seriously before the arrival of 1950 and continued throughout that decade, culminating in her D.Sc. degree in 1959, and progressing for the rest of her life. In the course of her work she visited other Herbaria in America and Europe, as well as revisiting Kew, always returning with information of value. With her natural tact, her developing diplomacy, and conviction of the rightness of her premises, she would not easily be distracted from her purpose. This, combined with her lucidity made her a formidable opponent in debate, for she rarely "lost her cool". Her studied contributions to the principle of Nature Conservation (when she saw it as a just cause, and before politics intervened), were valuable for these reasons, when she lent her support to it in relation to the then Kosciusko State Park, the Elouera Bushland Reserve and the Muogamarra Sanctuary. On behalf of the Kosciusko State Park she spoke authoritatively through letters in the press, and later compiled an excellent report, with copious photographs, at her own expense. For Elouera she served as a trustee and made a valuable gift of additional land to the Bushland Reserve, while her committee work and tactful handling of some difficult situations were of great help to the Muogamarra Sanctuary. Much of this was sandwiched in to her everyday work in the 'sixties, but here the highlight of the decade for Joyce was undoubtedly the recognition she received as a result of the "Bradley Case" in which her presentation of evidence (based on forensic work by the Herbarium botanists) led to the conviction of a murderer from plant fragments associated with his dwelling. She was always eager to share credit for this achievement with her co-workers, but there is no doubt that she was greatly pleased by this Royal recognition of her work, as well as of botanists' work, for she was strongly monarchist and conservative in her convictions. As she wished, the certificate and medal of the M.B.E. award have now been offered to and accepted by the Herbarium. In the 'sixties, Joyce was the recipient also of the Clarke Medal, presented by the Royal Society of New South Wales for her many contributions to science, and this too has now come to the Herbarium.

With the retirement of R. H. Anderson in 1964, Joyce's *de facto* position as leader of the Herbarium team was formalised and she became Senior Botanist to H. K. C. Mair. She had preferred not to occupy this position previously, disliking administrative duties, but now she accepted it in modified form, so that she had botanical work and research programmes in her charge, while all administrative work was the function of the Director. Four years later she retired, not to leisure but to attempt completion of still current research on Poaceae. She was given accommodation and facilities for this at the Herbarium, and a few years later (1973) recognition

of her work took the form of appointment as Honorary Research Fellow, renewed annually for the remaining six years of her life. Her research had culminated in a Flora treatment (Part I) of the family in 1961, and Part II was to follow in 1975; her last expressed goal, a revision of the genus *Stipa*, remains disappointingly, in unfinished MS., although initial steps towards completion of the work appear in this volume.

But retirement, even at the leisurely pace of an Honorary Research Fellow, was not to mean idleness—nor would she have wished it so. After the Second World War, the Linnean Society of New South Wales, of which Joyce had been a member since student days, had been facing problems of survival in a changing financial climate, and now its chief executive officer, Honorary Secretary W. R. Browne, was ill. Joyce responded to his appeal for relief and was elected Joint Honorary Secretary with him in 1969. She was relieved of this work after a short time, by the appointment of a professional secretary, but soon found a challenge to her early family training in the Society's need for a treasurer, becoming Honorary Treasurer in 1971. She went to great lengths to find ways of improving the investment income of the Society, now seriously disadvantaged by the provisions of its Founder's will. In conjunction with the Secretary, considerable liberalization of arrangements was achieved, but problems arose from the impact of the contemporaneous Redevelopment Plan for The Rocks area of Sydney. There the Society shared ownership of a valuable building, Science House. This property attracted substantial compensation for replacement by a new and diversified Science Centre, but now owing to an economic recession, there was anxiety as to the viability of this large investment, and objections to the plan. As usual, Joyce had studied her subject deeply, and was absolutely convinced not only that the carefully considered policies she had advised would succeed in time, but that the Societies had a moral obligation to pursue the object for which they had accepted somewhat specific government funding. Then her final illness overtook her, and her last days of effective consciousness were full of concern for this project. To Joyce the Science Centre, brought to successful realization and financial viability, would have been a significant contribution to Science in Australia. Perhaps in it she saw the same kind of material success, a building of value and usefulness to the community, as achieved by members of her family before her.

She has left not only a most significant contribution to Australian taxonomic botany, but a standard of consistency, excellence and integrity which will always be esteemed in the records of this institution, and among her many colleagues here and in other places.

Alma T. Lee

Publications of Joyce W. Vickery

1933: Vegetative reproduction in *Drosera peltata* and *D. auriculata*. *Proc. Linn. Soc. New South Wales* 58: 245–269.

1934: Australian insectivorous plants. *Sydney Univ. Sci. J., Trinity term:* 12–15.

1935: The leaf anatomy and vegetative characters of the indigenous grasses of New South Wales. I. Andropogoneae, Zoysieae, Tristegineae. *Proc. Linn. Soc. New South Wales* 60: 340–373.

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1972: A new name for *Poa exilis* J. Vickery and a new combination in *Brachiaria*. *Contr. New South Wales Natl. Herb.* 4: 250.

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1980: Four new species of *Stipa* (Poaceae). *Telopea* 2: 11–15.

1980: (Joyce W. Vickery and S. W. L. Jacobs.) *Nassella* and *Oryzopsis* (Poaceae) in New South Wales. *Telopea* 2: 17–23.

1980: (Michael, P. W. and Joyce W. Vickery.) Three new annual species of *Echinochloa* from northern Australia. *Telopea* 2: 25–29.

FOUR NEW SPECIES OF *STIPA* (POACEAE)

Joyce W. Vickery†

(Accepted for publication 2.11.1979)

ABSTRACT

Vickery, Joyce W. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. Four New Species of Stipa. *Telopea 2 (1): 11–15.*—Four new species of *Stipa* are described: *S. curticoma*, *S. gibbosa*, both from South Australia and Victoria, *S. exilis* from South Australia and Western Australia and *S. petraea* from South Australia.

INTRODUCTION

The descriptions of four new species published in this paper represent only a small part of the large amount of work on the genus *Stipa* left in manuscript and note form by Dr Joyce Vickery. The remaining new taxa require further study to relate them to the already named taxa recognized by Vickery. Therefore it seems desirable to make these names available now and appropriate to include them in this issue of Telopea dedicated to Dr Vickery.

The treatment follows Dr Vickery's original manuscript closely although, since Latin descriptions were not included, these have been kindly supplied by Karen Wilson after I extracted what I regarded as significant points from the descriptions.

I have done as little interpretation as possible and have confined changes to re-ordering the manuscripts, rationalizing the often multiple figures noted for dimensions, occasionally supplying missing information from the specimens and attempting to convert the original manuscripts, written at different times, to the current format required by this journal.

While the recognition, circumscription and description of the taxa are credited to Dr Vickery, I am responsible for any shortcomings in conveying the ideas and information.

S. W. L. Jacobs

Stipa curticoma *Vickery*, sp. nov.

S. aristiglumis F. Muell. affinis sed differt: glumis longioribus; lemmati longiore, callo longiore subrectoque.

Holotype: South Australia: Mt Lofty Ranges, 3 km S. of Mt Barker, *M. D. Crisp 884*, 13.10.1974 (CBG 058899).

Erect caespitose perennial 50–100 cm high, with extravaginal innovations from a closely contracted rootstock. Culms rather stout, striate, rigid, almost smooth, about 3-noded, the nodes densely retrorsely pubescent. Sheaths close around the culms or upwards at length becoming somewhat loose, often almost as long as the

† Died 29 May 1979

internodes, striate, smooth or minutely scaberulous, upwards ciliate on the outer margin. Ligule short, 1–1.5 mm, truncate, ciliate. Blades mostly flat *in vivo*, becoming loosely inrolled on drying especially upwards, acuminate, 20–30 cm long, 3.5 mm wide near the base, striate and smooth or minutely scabrous or more rarely distinctly scabrous or distantly hirsute on the lower surface with manifest nerves, rather strongly grooved and finely scabrous on the upper surface, with somewhat thickened auricles at the base. Panicle elongate, up to 30 cm long, more or less lanceolate, loose and loosely spreading, with distant fascicles or unequal branches up to 10 cm long, again divided, the spikelets mostly towards the ends of the branches and branchlets, the main axis terete, striate, finely scaberulous, the branches, branchlets and pedicels slightly flattened and angular, scabrous on the angles. Spikelets greenish and usually more or less strongly tinged with purple. Glumes rather broad and somewhat curved around the floret, acuminate, usually more or less scabrous-pubescent, firm, the lower 14–16 mm long, 3-nerved, the upper 5-nerved with the outermost nerves rather short and obscure, 10–13 mm long. Lemma 7–9 mm long including the 2–2.5 mm long callus, fusiform, minutely lobed, rather lightly clothed with erect, fine, white hairs which may tardily become more or less fulvous at maturity, these usually diminishing upwards towards the more or less clearly defined scabrous neck except for a fairly distinct coma of hairs about 0.5–1 mm long around the base of the column, the straight or very slightly retrorse acuminate callus densely clothed with fine white hairs, the awn 4.5–6 cm long, the column twice bent, moderately stout, scabrous-pubescent with rather short, stiff, erectly spreading hairs, the bristle scabrous. Palea as long as the lemma, with a band of hairs down the minutely granulate centre of the back. Anthers about 4 mm long, slightly fimbriate.

Distribution: From the Grampians in Victoria and in the Southern Lofty and Kangaroo Island areas of South Australia.

Specimens Examined: Victoria: Grampians, Mt Arapiles, *A. C. Beauglehole 29667*, 20.11.1968 (Herbarium of A. C. Beauglehole).

South Australia: **Southern Lofty Region:** Modbury, c. 15 km NE. of Adelaide, *A. G. Spooner 1274*, 24.10.1970 (AD); Near Highbury Hotel, c. 13 km NE. of Adelaide, *D. N. Kraehenbuehl 824*, 22.10.1942 (AD); Mt Lofty Ra., Highbury, *T. Smith 719*, 1.10.1967 (AD); Mt Lofty Ra., Highbury, Sassafras Drive, c. 15 km NE. of Adelaide, *A. G. Spooner 1318*, 12.10.1970 (AD); Mt Lofty Ra., Hope Valley, c. 10 km NE. of Adelaide, *J. B. Cleland* 15.11.1947 (AD 96323199); Black Hill, c. 12 km ENE. of Adelaide, *K. Czornij 253*, 21.11.1968 (AD); Adelaide Plain, Beaumont Common, *T. J. Smith 1730*, 28.8.1969 (AD); Adelaide Plains, Burnside district, Beaumont Common, *J. B. Cleland* 28.10.1928 (AD 96323194) and 24.10.1942 (AD 96324041); Adelaide Plains near Plympton, c. 5 km SW. of Adelaide, *T. J. Smith 1224*, 19.10.1968 (AD); Beefaeres, between Hope Valley Reservoir & Torrens Creek, *A. G. Spooner 2718*, 21.2.1973 (AD); Adelaide Hills, Belair, *F. Hilton* 13.10.1944 (ADW 44019); Belair, *C. M. Eardley* 10.19.1935 (ADW 2424); Claremont Hills, 11.1925 (ADW 278 in part); Waite Institute, *F. Hilton* 10.9.1946 (ADW 43836) and 4.11.1953 (NSW 116995 being duplicate of ADW 43831); Waite Institute grounds, *C. M. Eardley*, 10.11.1931 (ADW 251); Adelaide foothills, Netherby, *F. Hilton* 19.9.1944 (ADW 44015); Mt Lofty Ra. National Park, c. 6 km SE. of Adelaide, *J. B. Cleland* 17.12.1939 (AD 96323241); Mt Lofty Ra., Mt Barker, *J. B. Cleland* 4.12.1943 (AD 96323219) and 23.11.1946 (AD 96323197); Clarendon, 6 miles [10 km] SE. of O'Halloran Hill, *F. Hilton* 23.11.1945 (NSW 116993 being duplicate of ADW 43877); Mt Lofty Ra., Coxs Scrub National Park, c. 55 km SSE. of Adelaide, *B. C. Crisp 121*, 30.10.1971 (AD); Encounter Bay, Halls Creek, about 5 km W. of Victor Harbour, *J. B. Cleland* 5.1.1940 (AD 96323120). **Kangaroo Island:** Kangaroo I., Kingscote, *J. B. Cleland* 23.11.1945 (AD 96323120).

In habit and general appearance *S. curticoma* resembles some South Australian specimens of *S. blackii* but differs in that the coma of hairs at the apex of the lemma is very short. It differs from *S. eremophila* in its taller habit, essentially flat leaf-blades, mostly white (only tardily fulvous) hairs on the lemma, much shorter bristle and usually broader glumes. It differs from *S. flavescens* in its broader glumes, stouter awn with the column stiffly scabrous-pubescent (not very finely pubescent to pilose), and shows no particular preference for maritime or estuarine habitats. It differs from *S. aristiglumis* in its longer and almost straight callus, and appears to occur in quite different edaphic and geographic situations. It differs from *S. gibbosa* in its longer and more or less evenly fusiform lemma, usually longer awn, and usually narrower palea with a band of hairs down the middle of the back.

Stipa exilis *Vickery*, **sp. nov.**

S. mundulae J. M. Black affinis sed differt: laminis foliorum minute pubescentibus pilis longioribus interspersis, venis abaxialibus manifestis; ligula breviore obtusioreque; arista graciliore brevioreque; glumis brevioribus, lemmati breviore.

HOLOTYPE: South Australia: Northern Yorke Peninsula, Section 155, Hundred of Wiltunga (about 140 km NNW. of Adelaide), *B. Copley 799*, 21.10.1966 (AD 9670326).

Rather small, densely tufted perennials 40 cm high, with mostly basal leaves from intravaginal innovations. Culms erect, very slender, simple, about 2-noded, firm, grooved, glabrous, remotely scaberulous to scabrous pubescent. Nodes finely retrorsely pubescent. Sheaths tight around the culms, often as long as the internodes, scabrous pubescent, ciliate along the outer margin, striate with manifest nerves. Ligule firmly membranous, about 0.5 mm long, obtuse rather than abruptly truncate, usually with a tuft of hairs beside the lobes of the sheath. Blades very slender to almost capillary 5–25 cm long, convolute and terete or angular-terete, mostly scabrous pubescent to lightly hirsute on the outer surface, few nerved with the nerves quite manifest on the outer surface, erect or at length recurved, narrower than the apex of the sheath, about 0.5 mm in diameter, the inner surface pubescent. Panicle 5–15 cm long, rather few-flowered, at first loosely contracted, at length daintily spreading, with sparsely branching scabrous branches and scabrous pedicels, the axis almost smooth to sparsely scabrous. Spikelets rather small, rather narrowly gaping. Glumes membranous, narrow, very unequal, pale greenish or fringed with purple, the lateral nerves not extending to the tip, lightly scabrous pubescent; the lower 8–11 (–12) mm, very acuminate, 3-nerved, the upper 7–8 mm, acute, 5-nerved near the base. Lemma 4.5–5.5 mm including the 1–1.5 mm long callus, very minutely to shortly lobed, slender, lightly clothed with appressed white hairs, at first pallid, at length dark brown and finely scabrous. The awn capillary, 3.5–5.5 (–6) cm long, almost straight or lightly twice bent, finely scabrous or scabrous-pubescent. Palea about as long as the lemma, with a band of similar appressed white hairs down the centre of the back. Anthers about 1–1.5 mm long.

DISTRIBUTION: Murray, Northern Lofty, Yorke Peninsula and Eyre Peninsula regions of South Australia and in the South West of Western Australia.

SPECIMENS EXAMINED: SOUTH AUSTRALIA: **Murray Region:** Kinchina, *J. B. Cleland* 9.1922 (NSW 117042); 6 miles [10 km] W. of Murray Bridge, *R. L. Crocker* 23.10.1943 (CANB 12169); E. of Monarto (South), 12 miles [19 km] W. of Murray Bridge, *F. Hilton* 7.12.1954 (ADW 44134); Chauncevs Line [c. 20 km SW. of Murray Bridge], *J. B. Cleland* 30.11.1959 (AD 96806244), and 25.11.1949 (AD 96625059), and 30.11.1955 (AD 96806242), and 12.10.1938 (AD 96625087), and 25.9.1954 (AD 96625089), and 22.9.1962 (AD 96330048), and 12.10.1938 (ADW 44024); Chaunceys Line Reserve, *F. M. Hilton 1011*, 9.10.1954 (ADW), and *1008*, 9.10.1954 (ADW 44152 and NSW 117044 duplicate of ADW 44176); Tailem Bend, *F. Hilton* 12.12.1953 (ADW 44084); Ki Ki, 30 miles [48 km] SE. of Tailem Bend, *F. Hilton* 12.10.1953 (ADW). **Northern Lofty Region:** c. 5 km W. of Bute (old Mona railway yard) [about 130 km NNW. of Adelaide,] *B. Copley 494*, 14.8.1966 (AD); South Hummocks Range, *B. Copley 3228*, 25.10.1970 (AD). **Yorke Peninsula:** between Arthurton and Maitland, *B. J. Blaylock 1046*, 6.10.1968 (AD); c. 11 miles [18 km] SSW. of Port Broughton in relict of mallee scrub, *S. T. Blake 16848*, 28.8.1946 (BRI). **Eyre Peninsula:** Hambridge National Park [c. 140 km N. of Port Lincoln] *D. N. Kraehenbuehl 2070*, 8.10.1966 (AD); interdune flat between Prominent Hill and S. edge of Hambridge Reserve *D. E. Symon 4118*, 8.10.1966 (ADW); 15 miles [24 km] from Poochera towards Minnipa, Eyre Highway, *E. M. Canning 2277*, 30.8.1968 (CBG, NSW); Hincks National Park, Blue Range, Oak Amphitheatre, *C. R. Alcock 222*, 7.10.1968 (AD); Hincks National Park, Eagle Nest Flat, W. of Blue Range [about 100 km NNE. of Port Lincoln], *C. R. Alcock 2408* in part, 12.10.1968 (AD 96922396 in part); Hincks National Park, *D. E. Symon 6544*, 11.10.1968 (ADW), and 6256, 9.10.1968 (ADW); Hincks National Park, Eagle Flat, in the dune complex of the Blue Range, *J. R. Wheeler 1080*, 12.10.1968 (AD); Flora and Fauna Reserve, Hundred of Flinders, c. 15 km SSE. of Port Lincoln, *R. L. Specht 2636*, 10.11.1960 (AD).

WESTERN AUSTRALIA: 4 km E. of Needilup, *K. Newbey 4919*, 10.11.1975 (PERTH).

Differs from *S. mundula* in its intravaginal habit, rather finer, pubescent to hirsute leaves with the nerves manifest on the outer surface, its very obtuse rather than truncate ligule, more slender, capillary, and shorter awn, shorter glumes and lemma. The spikelets and lemmas resemble those of *S. multispiculis* but the short slender tufted habit of *S. exilis* is very different.

Stipa gibbosa *Vickery*, **sp. nov.**

S. aristiglumis F. Muell. affinis sed differt: flosculo dorsaliter distincte gibboso, ad apicem aequaliter decrescenti; planta plerumque parviore.

HOLOTYPE: South Australia: Burnside district, Beaumont Common, about 6 km SE. of Adelaide, *J. B. Cleland* 11.10.1942 (AD 96323216).

Erect caespitose perennial about 60–90 cm high with extravaginal innovations from a closely contracted rootstock. Culms about 3-noded, terete, striate, minutely scaberulous between the nerves but otherwise smooth, the nodes retrorsely pubescent. Sheaths at first moderately tight around the culm or at length becoming somewhat loose, strongly striate, minutely scaberulous on the sides of the nerves, otherwise smooth and glabrous, upwards slightly ciliate along the outer margin. Ligule short, about 0.5 mm, truncate, densely ciliolate. Blades linear, attenuate to the acuminate apex, at first ± flat, becoming loosely convolute or involute on drying, 20–30 cm long, 1–5 mm wide near the base, almost as wide as the apex of the sheath and somewhat auricular-thickened, manifestly nerved and loosely scabrous on the outer surface, or barely lightly hirsute, the inner surface conspicuously nerved and rather shallowly grooved between the nerves, minutely scabrous chiefly on the sides of the nerves, very firm. Panicle loose, often with most of the branches falling to one side, not densely flowered, 5–25 cm long, 3–5 cm wide neglecting the awns, rather sparsely branched with the spikelets towards the ends of the branches; the main axis terete, sparsely scabrous, the branches and especially the pedicels more or less angular or flattened and strongly scabrous especially on the angles. Spikelets pale greenish. Glumes rather broad and curving around the floret, acute to acuminate, firm, scabrous, unequal; the lower 11–17 mm long, manifestly 3-nerved; the upper 8–13 mm long, manifestly 5-nerved. Lemma 4.5–6 mm long (including the callus) and about 1.5 mm in diameter, narrowly obconical-oblong, narrowed at the neck, somewhat gibbous, closely clothed with erect white, to at length fulvous hairs and with a distinct coma of short hairs about 1 mm long at the apex, brownish to at length blackish, granulate, with a short, rather blunt callus 1–1.5 mm long densely clothed with hairs, and retrorsely curved. The awn 3–5 cm long, twice bent; the column about 1.5–2 cm long, scabrous; the bristle short (usually about as long as the column). Palea as long as or longer than the lemma, with broadly curving smooth sides and a flat granulate (otherwise glabrous) back between the nerves, rather abruptly narrowed into a subacute fimbriate apex. Lodicules spathulate, about 1 mm long. Anthers about 3 mm long, fimbriate. Grain oblong, slightly gibbous above, about 3.5 mm long, about 1–2 mm broad, obtuse, with an embryo about one-third as long.

DISTRIBUTION: From Victoria and the Northern Lofty and Southern Lofty Regions of South Australia.

SPECIMENS EXAMINED: VICTORIA: 4-7 km from Dimboola toward Nhill, *E. M. Canning 2972*, 11.11.1969 (CBG 067316 in part); 1 mile [1.5 km] S. of Laverton, *J. Cullimore 125*, 22.11.1967 (AD ex MEL; PERTH ex MEL).

SOUTH AUSTRALIA: **Northern Lofty Region:** Bundaleer Hills [c. 60 km SW. of Port Pirie], *J. M. Black* 23.11.1925 and 11.xi.1927 (AD); Bundaleer, c. 41 km N. of Clare, *J. B. Cleland* 28.11.1930 (AD 96323249); Spalding, [c. 158 km N. of Adelaide], *J. M. Black* 21.11.1925 (AD); c. 91 m E. of Snowtown Hospital [c. 130 km NNW. of Adelaide], *B. Copley 987*, 25.12.1966 (AD); Black Springs, 17 miles [27 km] S. of Burra, *D. Symon* 12.12.1953 (ADW 43833); E. of Mortlock Research Station, Mintaro, *D. E. Symon 3930*, 16.12.1965 (ADW; CANB; NSW). **South Lofty Region:** Adelaide Agricultural High School, 7.11.1932 (ADW); Beaumont Common, c. 6 km SE. of Adelaide, *J. B. Cleland* 23.10.1935 (AD 96323196), and 3.11.1940 (AD 96323292); Halls Creek, Encounter Bay, *J. B. Cleland H70*, 16.11.1930 (K).

From *S. aristiglumis* it differs in the distinctly dorsally gibbous floret (instead of ± uniformly fusiform narrowing evenly towards the apex), and its usually being a smaller plant. From *S. blackii* it differs in the very short corona of hairs at apex of lemma and more distinctly gibbous lemma. From *S. setacea* it differs in the truncate ligule, short ± obtuse callus, and palea not deeply furrowed down the back.

Stipa petraea *Vickery*, **sp. nov.**

S. juncifoliae Hughes affinis sed differt: foliis aliquantulo minus rigidis; ligula breviore, obtusa, dense ciliata; axibus inflorescentiarum ramisque pedicellisque scabris; glumis in nervis leviter scabris: lemmati sublongiore, paulo latiore fusiformi, pilis distincte fulvescentibus vestita.

HOLOTYPE: South Australia: Flinders Ranges: Brachina Gorge, Oraparinna National Park, western portion, *J. Z. Weber 2577*, 18.9.1971 (AD).

Caespitose perennial up to 75 cm high with extravaginal shoots, at first covered with elongate pubescent cataphylls, from a closely contracted rootstock. Culms erect, smooth, glabrous, rigid, about 3-noded, the nodes pubescent or glabrescent, not strongly exserted. Sheaths firm, close around the culm, striate, smooth ciliate on one margin especially upwards. Ligule short, 0.5–1 mm long, obtuse or truncate, more or less chartaceous, densely ciliate with long white hairs at the orifice and these continued up the inner surface of the base of the blade for about 1 cm. Blades linear, convolute, more or less erect and rather rigid, long attenuate into a fine point, up to 70 cm long, glabrous, smooth and lightly striate on the outer surface, densely long scabrous and furrowed on the inner surface, long hairy on the inner surface for a short distance about the ligule. Panicle loose or loosely contracted, 15–20 cm long, the main axis terete and, together with the branches and pedicels, the branches fasciculate, unequal, the longer up to 7 cm long and again branched, loosely flowered with the ultimate branches 2–4-flowered, the pedicels 1–10 mm long. Glumes pallid or purplish, often somewhat shining, narrowly gaping, rather broad to near the apex, subequal or a little unequal, 11–13 mm long, acuminate, membranous, moderately strongly nerved, lightly scabrous on the nerves and sometimes minutely scabrous between them; the lower 3-nerved with the lateral nerves extending about 3/4 way to the apex; the upper 5-nerved. Lemma linear-fusiform, rather thin, very distinctly bilobed at the apex with linear teeth about 1.5 mm long, about 8–9.5 mm long excluding the teeth but including the rather stout, pointed, densely hairy 1–1.5 mm long callus, pale brown, closely covered with appressed white to tawny hairs, the uppermost extending into a short corona about 2.5 mm long above the insertion of the awn, 5-nerved. The awn straight to loosely bigeniculate, about 4–5 cm long; the column 2–2.5 cm long, moderately slender, finely scabrous-pubescent to shortly pubescent, loosely twisted; the bristle scabrous, straight. Palea about as long as the lemma, oblong, shortly bilobed, similarly densely covered with tawny hairs in a broad band down the back. Anthers about 5.5 mm long, minutely penicillate.

DISTRIBUTION: Apparently endemic to the Flinders Ranges in South Australia, occurring in the Flinders Ranges and the Eastern Region close to the ranges.

SOUTH AUSTRALIA: **Eastern Region:** Mt Chambers Gorge [N. tip of Mt Frome between Flinders Range and Lake Frome, 33° 58′ S, 139° 17′ E], *R. Filson 3476*, 7.10.1960 (MEL). **Flinders Range:** Flinders Range, *E. H. Ising* 10.1918 (ADW 44065, 44068); Oraparinna National Park, rocky walls of Brachina Gorge, *D. E. Symon 2558*, 8.10.1971 (ADW, CANB); rocky cliffs, Horrocks Pass, Flinders Ranges, *F. Hilton* 12.9.1951 (ADW 44045, 44044); Oraiunga Creek near Mooloolo Section, NNW. of Blinman, *E. H. Ising* 1.10.1918 (AD). *Uncertain locality:* Cudnaka, *F. Mueller* (MEL 60684).

Very similar to *S. juncifolia* Hughes but differs in the slightly less rigid leaves, the shorter plants, the shorter, obtuse, densely ciliate ligule, the axis, branches and pedicels scabrous, the glumes lightly scabrous on the nerves, the rather longer lemma rather more broadly fusiform and covered with hairs which become distinctly tawny.

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NASSELLA AND *ORYZOPSIS* (POACEAE) IN NEW SOUTH WALES

Joyce W. Vickery† and S. W. L. Jacobs

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ABSTRACT

Vickery, Joyce W. and S. W. L. Jacobs (Royal Botanic Gardens, Sydney, Australia) 1980. Nassella *and* Oryzopsis *(Poaceae) in New South Wales. Telopea* 2 *(1): 17–23.*—The generic placement of *Nassella trichotoma* is discussed, particularly in relation to *Stipa*. A synoptic key is presented to distinguish the closely related genera throughout the world and a key included to distinguish the genera in New South Wales, followed by a taxonomic treatment for New South Wales of *Nassella* and *Oryzopsis* and a note on *Piptochaetium*.

INTRODUCTION

The genera *Stipa*, *Oryzopsis*, *Piptochaetium* and *Nassella* form a group of closely related genera in the tribe Stipeae (Clifford & Watson 1977). *Stipa* is a large genus with probably over 300 species in the temperate, rarely tropical, regions of the world, *Oryzopsis* a genus of about 24 species in the temperate and subtropical regions of the northern hemisphere, *Nassella* a South American genus of about 10 species and *Piptochaetium* a temperate South American genus of about 20 species. Although the generic limits within the group have always been somewhat ill-defined and there have been transfers from one genus to another, the genera *Oryzopsis* and *Piptochaetium* seem to be accepted by recent workers with little disagreement, (e.g., Rosengurtt et al. 1970; Gould 1975); the distinguishing characters are given in the key below. There is some disagreement about the generic distinctions between the genera *Stipa* and *Nassella; N. trichotoma* being one of the central species in the problem. *Stipa* is a very large and cosmopolitan genus whose limits are indeed difficult to define, especially in South America.

N. trichotoma certainly does not belong to either of the genera *Oryzopsis* or *Piptochaetium*, from both of which it differs in its very asymmetric gibbous lemma with tardily deciduous excentric awn, and from *Piptochaetium* it differs further in its nerveless palea shorter than the lemma and the lack of a corona on the lemma.

Generic placement of *Nassella trichotoma*

Some South American authors, such as Parodi (1944, 1947), Duren & Rosengurtt (1956) and Caro (1966) have rejected *N. trichotoma* from the South American genus *Nassella* and treated it (sometimes tentatively) as a species of *Stipa*. However, *N. trichotoma* would be a very aberrant species of *Stipa*, if placed in that genus, whereas it has many strong resemblances to other species of *Nassella* (cf. Parodi 1947). Its difference from the majority of species of *Stipa* was recognized by Corti (1951, see Caro 1966), who created the separate section *Nassellopsis* in *Stipa* in order to accommodate it.

Parodi (1947) lists laterally compressed spikelets, overlapping lemma margins, rudimentary paleas, easily deciduous awns, several-noded culms and sheaths shorter than the internodes as characteristics of *Nassella*. *N. trichotoma* differs in having few-noded culms and, supposedly, sheaths longer than the internodes. The immature inflorescence of *N. trichotoma* (the ones usually present on herbarium specimens) do have the sheaths longer than the internodes but on mature panicles the sheaths are shorter than the upper internodes. *N. trichotoma* has few (2–4) noded culms but Parodi describes *N. pubiflora* with 2–4 nodes and *N. fuscescens* with 3–5 nodes.

† Died 29 May 1979

In tentatively excluding *N. trichotoma* from *Nassella*, Parodi also lists the persistent awn and long setaceous leaves as being not characteristic of *Nassella* and suggests they are more characteristic of *Stipa*. The awn of *N. trichotoma* is perhaps more tardily deciduous than the awns of some other species of *Nassella* but it is still readily deciduous and quite different from the awns of at least the Australian species of *Stipa*. Long setaceous leaves do appear to be uncommon in *Nassella* but *N. juncea* is described as having "juniciform" convolute leaves, up to 8 cm long and 1.5 mm wide; shorter than but not dissimilar to the leaves of *N. trichotoma*.

N. trichotoma clearly falls within the concept of *Nassella* as expressed by Henrard (1929) in his key to the genera of the Stipeae.

Although desirable, it is not always necessary to have absolute character discontinuity before a genus can be segregated, and it is important to look at the assemblages of characters as well as the individual characters. In this particular example, we consider that the characteristics *N. trichotoma* shares with other species of *Nassella* are more important than the differences, which appear to be specialized trends with intermediate states in other species of *Nassella*. Our reasons for retaining *N. trichotoma* in *Nassella* may be assessed from the following comparative summary (Table 1) of some characters of the two genera and of *N. trichotoma*.

Synoptic Key to the genera *Stipa*, *Nassella*, *Oryzopsis* and *Piptochaetium*

1. *Lemma* usually several times longer than broad, cylindrical, fusiform, pyriform or turbinate, rarely slightly gibbous, tapering at the tip or rarely slightly 2-lobed, convolute and totally enclosing the palea. *Awn* from the apex of the lemma or from between its lobes, ± persistent or tardily deciduous, twisted in the lower part, generally once or twice geniculate. *Callus* longer than the width of the lemma, very oblique, sharp-pointed and bearded, rarely obtuse. *Corona* present or absent. *Palea* hyaline, 2-nerved and 1-keeled, flat or rudimentary or absent. *Lodicules* 3, rarely 2, hyaline, elongate, tapering to an obtuse tip. *Stamens 3*, the anthers often hairy at the tips. *Grain* fusiform-terete. *Hilum* linear, nearly as long as the grain. *Embryo* basal, about one-fifth the length of the grain ..... *Stipa*

1.* *Lemma* short and broad, or sometimes narrow and cylindrical in *Piptochaetium* but then not fully enclosing the palea and a corona usually present. *Awn* slender, deciduous. ..... 2.

2. *Lemma* elliptical-oblong or fusiform or ovate, not gibbous at the top. *Awn* terminal and central from the minutely lobed apex, straight, very readily deciduous. *Corona* reduced or absent. *Callus* short and obtuse. *Palea* shorter than to subequal to the lemma, embraced by but not totally enclosed by its margins, 2-nerved. *Grain* readily separable from lemma and palea, oblong, sub-terete. *Stamens* 3. *Lodicules* 2, rarely 3, hyaline. ..... *Oryzopsis*

2.* *Lemma* asymmetric, gibbous at the summit, obliquely obovate, or narrow and cylindrical in species of *Piptochaetium* but then with a distinct *corona*. *Awn* excentrically attached, readily deciduous. ..... 3.

3. *Palea* short, hyaline, without nerves or keels. *Lemma* obliquely obovate, asymmetric, gibbous at the summit, entirely enclosing the palea, rigid. *Corona* absent. *Callus* short, not as long as the width of the lemma, not strongly oblique, not long-pointed. *Lodicules* 2, obtriangular, truncate. ..... *Nassella*

3.* *Palea* rigid, crustaceous or coriaceous, 2-keeled with a median furrow between the keels, exposed between the margins of the lemma and the tip projecting beyond the lemma. *Lemma* obliquely obovate or pyriform, asymmetric and gibbous or cylindrical and not conspicuously gibbous, the apex acute or obtuse, not enclosing the palea and having a suleus on the palea side. *Corona* usually present. *Awn* persistent or caducous, centric or excentric, often bigeniculate. *Lodicules* 3, lanceolate. ..... *Piptochaetium*

Key to *Stipa*, *Nassella* and *Oryzopsis* in New South Wales

1. Awn excentric, readily to tardily deciduous. Inflorescence disarticulating as a unit, old inflorescence stalks not left on plant. ..... *Nassella*

1.* Awn terminal and central, persistent or deciduous. Spikelets disarticulating individually from the inflorescence and old inflorescence stalks persistent. ..... 2.

2. Lemma ovoid with a terminal deciduous awn; callus shorter than the width of the lemma. ..... *Oryzopsis*

2.* Lemma cylindrical, rarely gibbous, with a terminal persistent awn; callus usually longer than the width of the lemma. ..... *Stipa*

TABLE 1.

Summary of characters of *Stipa*, *Nassella* and *Nassella trichotoma*

Character	Nassella	N. trichotoma	Stipa
Culms ..	slender to firm, usually not persistent.	very slender to capillary, absent from old tussocks.	firm, persistent and recognizable in old tussocks.
Panicle ..	persistent or deciduous.	deciduous and usually removed before the florets have fallen from the glumes.	persistent, with the florets falling *in situ* from the glumes.
Spikelets ..	rather small.	rather small.	large to rather small.
Lemma ..	ovoid or asymmetrically elliptical, not more than twice as long as broad, 1–3 mm long, usually more or less strongly gibbous, without a corona.	ovoid, asymmetrical, very strongly gibbous, without a corona, 2 mm long and 1 mm wide.	cylindrical or very narrowly ellipsoid, several times as long as broad, more than 3 mm long including the callus, not or only slightly gibbous, with or without a corona.
Awn ..	excentric, filiform, straight or flexuose, slightly twisted in the lower part, glabrous, inconspicuously articulate and tardily to readily deciduous.	excentric, filiform, straight or flexuose, only slightly twisted in the lower part, glabrous, inconspicuously articulate and tardily deciduous.	terminal and centric, usually rather strong, manifestly articulate with the lemma, persistent or tardily deciduous, usually differentiated into a more or less strongly twisted column and a straight or curved bristle, often geniculate, glabrous, plumose or variously hairy scabrous.
Callus ..	short (shorter than the diameter of the lemma), slightly oblique, obtuse or minutely acute.	short (shorter than the diameter of the lemma), obtuse or minutely acute, very slightly oblique.	long (longer than the diameter of the lemma), very oblique, usually pungent-pointed (? rarely obtuse).
Palea ..	nerveless.	nerveless.	2-nerved, rarely rudimentary or absent.
Lodicules ..	2, obtriangular, truncate.	2, obtriangular, truncate.	usually 3, rarely 2, elongate, tapering to an obtuse point.
Stamens ..	3, without a hairy tip.	2 (or 3) with only 1 anther fully developed and 1 (or 2) staminodes, without a hairy tip.	3, the anthers often hairy at the tips.
Grain ..	oblong to obliquely pyriform, slightly compressed.	obovoid (pyriform) and slightly compressed.	fusiform-terete.
Embryo ..	one-third to one-half the length of the grain.	almost one-half the length of the grain.	about one-fifth the length of the grain.
Hilum ..	linear and about two-thirds the length of the grain.	linear and about two-thirds the length of the grain.	linear, nearly as long as the grain.

TAXONOMIC TREATMENT OF *ORYZOPSIS* AND *NASSELLA* AND A NOTE ON *PIPTOCHAETIUM*

ORYZOPSIS Michx.

Spikelets solitary, pedicellate, hermaphrodite, 1-flowered with the floret disarticulating above the glumes and the rhachilla not produced beyond the floret, borne in open or more or less contracted panicles. *Glumes* equal or slightly unequal, obtuse to acute or acuminate, membranous to firm, usually 3- to 5-nerved. *Lemma* shorter than to about as long as the glumes, rigidly membranous to coriaceous or indurate, oval, oblong, lanceolate, ovate-lanceolate or obovate in outline, convolute, appressed-pubescent to glabrous, 3- to 5-nerved, with a short, blunt, oblique callus, terminally or subterminally awned with the awn deciduous, slender, glabrous, straight or more or less geniculate. *Palea* shorter than to subequalling the lemma and embraced by its margins, 2-nerved. *Stamens* 3. *Lodicules* 2, rarely 3, hyaline, rather large. *Ovary* glabrous; styles free, short; stigmas plumose, laterally exserted. *Grain* oblong, oval or obovate in outline, terete, tightly enclosed by the hardened lemma and palea. Caespitose *perennials*. *Sheaths* open. *Ligules* membranous, truncate to elongate. *Blades* flat to involute.

A genus of about 24 species mostly native to the temperate and subtropical regions of the northern hemisphere. One naturalized in Australia.

***O. miliacea** (L.) *Aschers. et Schweinf.*, Mém. Inst. Égypte 2: 169 (1887); Summers in J. Dept. Agric. South Australia 10: 418, phot. (1907); J. M. Black, Naturalized Fl. South Australia: 169, figured (1909), Fl. South Australia: 67 (1922) and edn 2: 93, fig. 111 (1943); Breakwell, Grasses & Fodder Pl. New South Wales: 107, 108 phot. (1923); Ewart, Fl. Victoria: 183, fig. 96 (1931); Hitchcock & Chase, Manual Grasses United States: 437, fig. 625 (1951); C. A. Gardner, Fl. Western Australia 1, Gram.: 183 (1952); J. H. Willis, Handb. Pl. Victoria 1: 189 (1962) and edn 2, 1: 189 (1970); Beadle, Evans & Carolin, Handb. Vasc. Pl. Sydney Distr.: 532 (1963); Burbidge, Austral. Grasses 3: 56, Pl. XIII (1970); Beadle, Evans & Carolin, Fl. Sydney Region: 657 (1972).

Synonymy: *Agrostis miliacea* L., Sp. Pl. 1: 61 (1753). *Piptatherum miliaceum* (L.) Coss., Not. Crit.: 120 (1851).

Milium multiflorum Cav., Pl. Descr.: 36 (1802). *Piptatherum multiflorum* (Cav.) Beauv., Agrost.: 18, 168, 173 (1812).

Milium thomasii Duby in Candolle, Bot. Gall. 1: 505 (1828). *Piptatherum thomasii* (Duby) Kunth, Rev. Graminées 1 Suppl.: XIV (1830).

Distribution: North and Central Coast, Northern and Central Tablelands, Central and South Western Slopes, Western and Far Western Plains, usually in situations sheltered from grazing by stock. Also in Victoria, Tasmania, South Australia and Western Australia; used to stabilise mine-dumps in moist and semi-arid regions in the southern half of Australia and frequently spreading from such plantings. Native to the Mediterranean region; introduced into Australia and North America.

Tufted *perennial* with a strong contracted rhizome with extravaginal innovations, glabrous except for the pubescent cataphylls. *Culms* slender to rather stout, rigid, wiry, leafy, branching and often with fascicles of branches at the nodes, erect, 60–150 cm long, subsmooth, 6- to 7-noded. *Sheaths* usually shorter than the internodes, tight around the culm, smooth, striate. *Ligule* hyaline, very obtuse or truncate, 2–3 mm long. *Blades* flat, 7–35 cm long, 8–10 mm wide, linear, finely long-acuminate, slightly scabrous above, smooth and often almost shining below, the midrib somewhat prominent below. *Panicle* 15–40 cm long, loose, open, the numerous, capillary, scabrous branches verticillate at the nodes, spreading and somewhat drooping towards their tips, branching to the second or third degree, bearing numerous, small, shortly pedicellate spikelets above the middle. *Spikelets* lanceolate, 3–3.5 mm long, greenish to purplish. *Glumes* membranous to hyaline, as long as the spikelet, long-acuminate, slightly unequal, pale greenish to purplish. *Lemma* 1.8–2 mm long, ovoid, shortly

notched at the summit, smooth, glabrous, hardened around the fruit and shining at maturity, bearing a terminal, readily deciduous, straight, capillary awn 2–4 mm long. Palea as long as the lemma, 2-nerved. *Anthers* c. 1 mm long. *Caryopsis* oblong, subterete. "Rice Millet", "Many-flowered Millet Grass", the "Smilo Grass" of the U.S.A.

Specimens Examined: **North Coast:** Wollongbar Experimental Farm, cult., *NSW 115744*, 12.1903. **Central Coast:** Botanic Gardens, Sydney, cult., *Boorman NSW 115749*, 5.1905; Homebush, *Vickery NSW 17931*, 11.1932; Hawkesbury Agricultural College, Richmond, cult., *NSW 115758*, 3.1909, *The Principal NSW 115761*, 11.1908. **Northern Tablelands:** Armidale. *Vane NSW 115735*, 1.1965. **Central Tablelands:** Orange district, *Madsen NSW 115752*, 12.1950; Bathurst Experiment Farm, *NSW 115746*, 3.1903. **Southern Tablelands:** Black Mtn, Canberra (A.C.T.), *Gray 5788*, 11.1965 (115737). **Central Western Slopes:** Cassilis, *Henry NSW 115755*, 5.1931; Boree Creek, *Cornell NSW 115736*, 11.1938; Cowra, *Brown NSW 115741*, 7.1961, *McBarron 9158*, 8.1964 (NSW); Young, cult., *Thomber NSW 115760*, 2.1908; Young, *NSW 115747*, 1933. **South Western Slopes:** Murrumburrah, *Morgan NSW 115748*, 12.1940; Springfield, North Wagga, *Commins NSW 115754*, 1.1934; Wagga Wagga, *Stening NSW 115756*, 10.1913, *Hutchinson NSW 115751*, 3.1972; Wagga Experimental Farm, *The Manager NSW 115753*, 9.1904; Wagga Wagga Soil Conservation Research Station, *NSW 115763*, 1955; Albury, *Yates & Co. NSW 115745*, 3.1913, *McBarron 1392*, 2.1948 (NSW). **Western Plains:** Leeton district, *Watkins NSW 115743*, 11.1950. **Far Western Plains:** Broken Hill, *Morris NSW 115742*, 3.1921.

A drought resistant grass of which the young foliage is palatable to stock but the mature tussocks with their wiry stems are not. Its virtual restrictions to sites sheltered from stock, such as gardens and waste land in country townships, indicates that it does not withstand grazing. It is somewhat decorative.

O. hymenoides (*Roem. & Schult.*) *Ricker* has been cultivated experimentally by the CSIRO at Ginninderra, Canberra (A.C.T.) [*Strong NSW 115733*, 11.1962].

NASSELLA E. Desv.

Spikelets all alike, hermaphrodite, 1-flowered with the rhachilla not prolonged beyond the floret. *Glumes* 3-nerved, lanceolate, acuminate, longer than the floret, subequal, persistent, with the lower back more or less herbaceous and greenish or purplish, the margins and apices scarious or hyaline. *Floret* obovate, obliquely pyriform, oblong or lanceolate, gibbous, slightly laterally compressed, without a corona, 1–3 mm long, with an excentric awn. *Lemma* cartilaginous and rigid or papery, glabrous or pubescent, the margins strongly overlapping and completely concealing the palea and flower, the callus very slightly and shortly oblique, obtuse or very shortly acute, glabrous or pilose, the awn slightly and loosely twisted or slightly geniculate or flexuose, deciduous, 1–3 cm long. *Palea* 1-nerved or nerveless, much shorter than the lemma, often hyaline, included within the lemma. *Stamens* 3, sometimes 1 or 2 of them reduced to staminodes or absent. *Ovary* oblong or fusiform with short styles and short, lightly plumose stigmas. *Caryopsis* oblong to obliquely pyriform or obovoid, very slightly compressed, the hilum linear. *Perennials*, usually with several-noded, usually branching, culms or these simple with inconspicuous nodes and short internodes at the base of the elongate peduncle, in the former case the sheaths usually shorter than the internodes. *Ligules* short. *Blades* flat or involute, acuminate. *Inflorescence* a contracted or open panicle.

A South American genus of about 10 species chiefly in or near the Andes extending from Ecuador southwards to lat. 42° in Patagonia. One species naturalized in Australia, New Zealand and the United States.

***N. trichotoma** (*Nees*) *Hack. ex Arech.*, Anales Mus. Nac. Montevideo 1: 336, fig. 19 (1896); Cross, Agric. Gaz. New South Wales 48: 546–548, figured (1937); Allan, New Zealand J. Agric. 63: 91–95 (1941); Cross & Vickery, Contr. New South Wales Natl. Herb. 1: 278 (1950); Blakelow, Tasmanian J. Agric. 31: 458–464, figured (1960); Campbell, Agric. Gaz. New South Wales 71: 9–19, figured, and 561

(1960) and ibid. 76: 679–687, figured (1965); J. H. Willis, Handb. Pl. Victoria 1: 188 (1962) and edn 2: 188 (1970); Goodyear, J. Agric. (Melbourne) 62: 314–317, figured (1964); Whittet, Weeds edn 2: 361–363, phot. (1968); Burbidge & Gray, Fl. Austral. Cap. Terr.: 54, fig. 46 (1970). Extensively mentioned in the Agricultural literature of eastern Australia and New Zealand since 1937.

SYNONYMY: *Stipa trichotoma* Nees, Agrost. Bras.: 375 (1829); Parodi, Revista Muse de la Plata, Secc. Bot. 6: 306 (1944); Parodi, Darwiniana 7: 369 (1947); Durán & Rosengurtt, Agros (Montevideo) No. 141: 12 (1956); Caro, Kurtziana 3: 79 (1966). *Urachne trichotoma* (Nees) Trin., Mem. Acad. St. Pétersb. ser. 6, Sci. Nat. 1: 124 (1834). *Piptochaetium trichotoma* (Nees) Griseb., Symb. Fl. Arg.: 297 (1879).

DISTRIBUTION: Naturalized and widely distributed on the Central and Southern Tablelands, more infrequently extending to the Northern Tablelands, Central Western Slopes and South Coast; also in Victoria and Tasmania. Native to South America; introduced into Australia and New Zealand.

Densely caespitose *perennial* with very numerous, often sterile, intravaginal innovations and wiry roots, the tussocks 20–60 cm high. *Culms* 2- to 4-noded but the nodes not thickened, quite inconspicuous and chiefly towards the base, very slender to almost capillary and each internode becoming attenuate downwards, simple, terete, smooth, glabrous. *Sheaths* tight around the culms or open towards the base of the plant, lightly striate, glabrous and smooth except for the more or less scaberulous margins, erect. *Ligule* opaque-whitish, papery, obtuse or truncate, 0.5–2.5 mm long, glabrous and smooth or more or less scaberulous on the back, symmetrical or asymmetrical and sublateral. Blades straight or curving outwards in the upper one-third, convolute-filiform, setaceous, c. 15–45 cm long, 0.25–0.5 mm in diameter, finely but not pungently pointed, the exterior surface minutely and rather distantly scaberulous, not striate with nerves, the interior surface scaberulous, few-nerved and furrowed between the nerves. *Panicle* at first more or less included in the uppermost sheath and then contracted, at length shortly exserted, pyramidal, very effuse with rather few spikelets towards the tips of the ultimate branches, erect, 15–25 cm long, often purplish from the colour of the glumes, the main axis somewhat compressed and planoconvex, antrorsely scabrous on the edges, the filiform branches 2- to 3-nate, scabrous-pubescent, the lower up to 10 cm long, again unequally branched and the spikelets borne on the ultimate branchlets on long capillary pedicels compressed upwards and only slightly thickened at their tips. *Spikelets* narrowly lanceolate. *Glumes* much longer than the floret, narrowly lanceolate, finely long-acuminate into a hair-like tip, the lower part of the back membranous and usually purplish, the margins upwards and the apex thinly hyaline, 3-nerved with the lateral nerves shorter and converging towards the median nerve, subsmooth, loose around the floret, somewhat unequal with the lower glume 6–8.5 mm long and c. 1.5 mm wide, slightly scabrous on the lower part of one margin, the upper glume 5–7 mm long and almost as wide as the lower. *Floret* obovate, very gibbous on the back, slightly compressed, without a corona, 1.5–2 mm long (without the awn), c. 1 mm wide. *Lemma* obscurely (at least on the outer surface) 5-nerved, strongly antrorsely scabrous upwards, otherwise glabrous, straw-coloured or somewhat purplish, with a very excentric filiform awn, the margins overlapping and tightly enclosing the palea and flower, the awn more or less straight or flexuose, 2–3.5 cm long, slightly twisted in the lower part, minutely scabrous, inconspicuously articulate with the lemma but not dilated at the base and rather tardily deciduous, the callus shortly oblique, shorter than the diameter of the body of the lemma, obtuse or minutely pointed, bearing white, erectly divergent unequal hairs up to 1.5 mm long. *Palea* thinly hyaline, elliptical to oblong, obtuse or the apex more or less irregular, nerveless, glabrous, c. one-half to one-third as long as the lemma. *Lodicules* 2, very thinly hyaline, obtriangular and truncate, or more or less oblanceolate and irregular, glabrous, nerveless, c. 0.25–0.75 mm long. *Stamens* 2–3 with only 1 anther fully developed in all specimens examined and another 1 (or 2) abortive. *Caryopsis* obovoid, turgid, lightly compressed, c. 1.2–1.5 mm long and c. 0.5 mm in diameter, brown, the hilum linear, straight, inconspicuous, c. two-thirds as long as the grain, the scutellum broad, almost half as long as the grain. "Serrated Tussock", "Yass Tussock".

SPECIMENS EXAMINED: **South Coast:** Bega River, *Hindle NSW 115765*, 11.1965. **Northern Tablelands:** Rockvale via Armidale, *Green NSW 115767*, 10.1955. **Central Tablelands:** Orange, *Madsen NSW 51322*, 2.1948; Blayney, *Shire Clerk NSW 3109*, 3.1947; Neville via Blayney, *Radburn NSW 115766*, 1.1949; Moss Vale, *Rodway NSW 89844*, 7.1937; 4 miles [7 km] N. of Berrima, *Green NSW 115775*, 6.1950; Carcoar, *Charles NSW 115770*, 12.1948; Rockley, *Cobb NSW 115760*, 12.1948; Oberon district, *Cantrill NSW 2264*, 11.1946. **Southern Tablelands:** Gibraltar Creek arca, Paddys River district, *Pullen 3708A, 3708B (NSW)*, 11.1962; "Murray Flats", Goulburn, *Fitzgerald NSW 115768*, 11.1946 and *NSW 4743*, 12.1947; Gunning, *Shire Clerk NSW 51321*, 12.1943; Yass, *Shire Clerk NSW 115759*, 2.1936, *NSW 115762, 115764*, 11.1936; Yass, *Dunlop NSW 89840*, 10.1939; Yass, *Sleeman NSW 115774*. **Central Western Slopes:** Mudgee district, *Sengelman NSW 115773*, 11.1962.

In South Ameriea this grass is reported to be eatcn by eattlc, but in Australia it is neglected by stoek, tends to over-run pasturcs and seriously reduces thc valuc of infested propertics. Its panicles, bearing minutc seeds, arc casily detached from thc tussock, lifted by even thc lightest breeze, and may be carried scveral kilometres by wind. Any tussock permitted to fruit may thus infect properties over a considerablc radius from thc source. It is therefore regarded as a serious noxious weed especially in Tablelands districts whcrc it appears to thrive best. Control mcasurcs have received extensive study by agronomists.

PIPTOCHAETIUM Presl

P. stipoides (*Trin. et Rupr.*) *Hack. ex Arech.* has been cultivated experimentally at the Botanic Gardens from seed from Uruguay [*Vickery NSW 115730*, 11.1953].

P. bicolor (*Vahl*) *Desv.* has been cultivated experimentally by the CSIRO at Ginninderra, Canberra (A.C.T.) [*Strong NSW 115731, 115732*, 11.1962].

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THREE NEW ANNUAL SPECIES OF *ECHINOCHLOA* FROM NORTHERN AUSTRALIA

P. W. Michael and Joyce W. Vickery†

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ABSTRACT

Michael, P. W. (Department of Agronomy and Horticultural Science, University of Sydney, New South Wales, Australia, 2006) and Joyce W. Vickery (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, New South Wales, 2000) 1980. Three New Annual Species of Echinochloa *from Northern Australia. Telopea 2 (1): 25–29.—Echinochloa kimberleyensis* Michael et Vickery, *E. macraudra* Michael et Vickery and *E. elliptica* Michael et Vickery are described.

In our examination of Northern Australian specimens of *Echinochloa* previously assigned to *E. stagnina* (Retz.) Beauv. in Australian herbaria, it became clear that three undescribed taxa were included. The three taxa described here are tall annual grasses growing in wet places.

Echinochloa kimberleyensis *Michael et Vickery*, **sp. nov.**

Gramen annuum usque ad 2 m altum. Ligulae foliorum summorum brevissime ciliatae foliorum inferiorum glabrae vel vix ciliatae. Spiculae 5–7.5 mm longae anguste ellipticae longe aristatae versus basim leniter deerescentes. Gluma superior breviter stipitata. Flosculus inferior neuter. Palea inferior angusta ad dimidium lemmatis attingens raro nulla. Antherae floseuli superioris 1.5–2.1 mm longae. Caryopsis albida.

Holotype, Western Australia: grown at Kimberley Research Station, *E. C. B. Langfield 211*, dispatched 10.1950 (CANB 24391). Isotype: CANB 24391a.

Rather light green, erect annual up to c. 2 m high. Culms mostly concealed by the leaf-sheaths, smooth, glabrous, furrowed but otherwise more or less terete, compressible, moderately coarse and up to 5 mm in diameter towards the base, diminishing upwards, about 5-noded above the base. Nodes glabrous. Sheaths much longer than the internodes, striate, smooth, glabrous, rather loose upwards, somewhat keeled upwards, greenish to pallid, the lowest sometimes slightly pinkish, the margins with a few stiff, long, tubercle-based cilia near the junction with the blade. Ligules of the upper leaves shortly and rather sparsely ciliate with the cilia 0.25–1.0 mm long, those of the lower leaves decreasingly so or entirely glabrous, the collar sometimes pubescent. Blades linear, flat, the lower rather narrow and about 4–6 mm wide, the upper broader and up to 16 mm broad, scabrous on the margins and with distant, long, very stiff setulose hairs on the thickened, whitish, scabrous margins especially near the junction with the sheath, light green, finely long-acuminate, shortly to rather abruptly narrowed into the sheath at the base, finely and densely scaberulous on both surfaces, the rather narrow midrib prominent with 3–6 primary nerves on each side of it. Panicle at length exserted, erect or somewhat drooping, linear to very narrowly lanceolate, up to 25 cm long, with long, appressed or narrowly divergent branches loosely clothed with long-awned spikelets, the main axis terete towards the base, upwards becoming angular-triquetrous, prominently striate, closely long-scabrous on the angles and ridges upwards and with dense long setae at the nodes, the lower branches rather distant, c. 7 cm long, with short secondary branches towards the base, the rhachis compressed-triquetrous, very scabrous and with rather numerous, long, tubercle-based, branch setae, the pedicels 0.25–1.25 mm long, cupular-discoid at the apices. Spikelets 5–7.5 mm long, narrowly elliptical, narrowing evenly towards the extremely short constricted base, long-awned, not turgid, pale greenish, the glumes and lower lemma membranous-herbaceous. Lower glume

† Died 29 May 1979

about half as long as the spikelet, 3-nerved with the middle nerve rather evident and the lateral nerves less so, acute to acuminate, scabrous on the nerves and scarcely so between them, finely and shortly but stiffly ciliolate on the margins, embracing the base of the spikelet, not or scarcely inflated above the not or extremely shortly constricted base. Upper glume minutely stipitate above the lower glume, the shape and size of the spikelet, convex on the back, acuminate, long-cuspidate, scabrous to shortly spinulose on the nerves with the spinules rarely exceeding 0.3 mm in length, distantly scabrous between the nerves, 7-nerved with the nerves manifest at least near the apex. Lower floret sterile: Lemma similar to the upper glume but flat or lightly depressed on the back, 5-nerved, shortly spinulose on the nerves with the spinules rarely exceeding 0.3 mm in length, very distantly scabrous or almost smooth between them, long-acuminate passing into a pale, strong, scabrous awn up to 8.5 cm long; palea firmly hyaline, much narrower than and often only half the length of the lemma, finely ciliolate on the keels upwards, sometimes absent. Upper floret hermaphrodite, 5–6.5 mm long, narrowly elliptical, planoconvex, pale greenish or yellowish: lemma thinly crustaceous, convex on the back, very obscurely 5-nerved, cuspidate to rather long-cuspidate, the smooth shining back passing evenly into the scabrous cusp, occasionally (perhaps as an abnormality) the cusp extending into an awn up to 4 cm in length; palea similar to the lemma in texture, flat on the back, almost as long as the body of the lemma, the curving sides embracing the flower, the margins slightly thinner, broader towards the base. Anthers 1.5–2.1 mm long, yellow, grain oblong elliptical, 2.75–3.5 mm long, 1.5–1.75 mm wide, creamy-whitish, not strongly turgid, the embryo one-half to three-fifths as long.

DISTRIBUTION: Often growing in dense stands in and on the edge of swamps along the Ord River, Victoria River in north western Australia and in the Cook District of Queensland.

SPECIMENS EXAMINED: QUEENSLAND: **Cook District:** 24 miles [39 km] NW. of Strathmore Station, dominant on edge of swamp, *M. Lazarides 3913A in part*, 8.1953 (CANB); Forest Home Station, very abundant in swamps, *L. J. Brass 1886*, 4.1931 (BRI, CANB, K). WESTERN AUSTRALIA: Milligans Lagoon, East Kimberleys, shorter growing than *Oryza fatua*, 7 ft [2.1 m] high, base of stem red, *E. C. B. Langfield 211*, 4.1950 (BRI, CANB); Martins Swamp, East Kimberley, in black soil swamp in 2 ft [0.6 m] of water *E. C. B. Langfield 211*, 10.4.1950 (PERTH); Martins Swamp, 6 miles [10 km] NW of Kimberley Research Station, swampy localities, growing very heavily in large areas, apparently native, base of stem red for up to 6 in (15 cm), *E. C. B. Langfield H*, 7.1952 (CANB); near Kimberly Downs Station, co-dominant with *Leptochloa brownii* in heavy soil depression of flood out plain, *M. Lazarides 6593A*, 6.1961 (CANB). NORTHERN TERRITORY: Victoria River, [probably *F. Mueller*, 10.1855] (MEL).

Material of this species was identified as *E. stagnina* (Retz.) Beauv. by Blake (1952) who cited the specimens from Forest Home Station and Milligans Lagoon.

E. kimberleyensis superficially resembles *E. oplismenoides* (Fourn.) Hitchc. of Mexico which, however, has much less dense panicles and blackish anthers only about 0.6 mm long.

The spikelets of *E. kimberleyensis* have much in common with those of *Echinochloa crus-galli* (L.) Beauv. var. *bealananensis* A. Camus, of Madagascar. The Holotype of the latter (Marais de Bealanana, bords de rivières, Centre-Nord, Vernae: Karengy, leg. H. Humbert & R. Capuron [P]), which we have examined, shows a plant with robust lower culms 8–10 mm diameter very strongly rooted at the lower nodes suggesting that it was somewhat horizontal (and rhizome-like) at the base. The culm is about 1.5 m long to the tip of the 37 cm long inflorescence; the lower branches of the latter are up to 12 cm long. The spikelets are all immature and, at this stage at least, appear a little shorter and flatter than those of *E. kimberleyensis*. Ligules on all the leaves present are strongly ciliate with the cilia 1–3 mm long. The blades do not bear stiff, strongly tubercle-based, spinulose hairs on the margins towards the base, and are not densely scabrulous on the surfaces. The anthers are blackish and about 1 mm long.

We have concluded therefore that *E. kimberleyensis* and *E. crus-galli* var. *bealananensis* are not conspecific. Incidentally the latter is clearly entirely distinct from *E. crus-galli*.

Echinochloa macrandra *Michael et Vickery*, **sp. nov.**

E. kimberleyensis Michael et Vickery affinis sed ligulis omnibus dense ciliatis, spiculis latioribus ad basim anguste truncatis, flosculo inferiore masculino, palea inferiore latiore longiorque, antheris 2.5–2.8 mm longibus.

HOLOTYPE: WESTERN AUSTRALIA: "The Razorbacks", near 65 mile peg on Wyndham—Darwin road, Kimberley, swamp on heavy grey clay, annual in damp mud, seed voucher (CSIRO Accession No. W662), *N.T. Burbidge 5185*, 17.4.1956 (CANB 35478). ISOTYPE: CANB 35480.

Tall erect annual, 0.8–2 m high, rooting in mud. Culms simple or sparsely branching, moderately stout and up to 6 mm in diameter towards the base, more slender upwards, yellowish, terete, somewhat compressible, coarsely and rather distantly striate, smooth, glabrous, 6- to 7-noded, often mostly concealed by the leaf-sheaths. Nodes glabrous. Sheaths often longer than the internodes, greenish or pinkish, smooth or subsmooth, lightly striate, glabrous except sometimes fringed with long, fine, tubercle-based hairs on the margins near the apex, often keeled upwards, the lower very broad, becoming loose around the culm and thinly submembranous. Ligules of both upper and lower leaves shortly but rather densely ciliate with fine cilia 1–1.5 mm long, the collar pubescent. Blades linear, flat, up to 25 cm long and 12 mm broad, tapering to an acuminate or long-acuminate apex, rounded into the sheath at the base, often scabrous on the nerves and otherwise smooth or minutely scaberulous, sometimes pinkish on drying, sometimes with a few very long, stiff, tubercle-based hairs on the margins near the base, with a manifest but narrow, whitish midrib and about 6 primary nerves on each side of it, the margins whitish, thickened, scabrous. Panicle exserted, erect, more or less lanceolate in outline with the lower branches erectly or somewhat loosely spreading, the upper branches more erect, the main axis terete below and becoming angular-triquetrous upwards, closely scabrous with numerous nodal setae, the lower branches somewhat distant and up to 7 cm long, the upper shorter and more approximate, all rather loosely clothed with spikelets, the rhachis of the raceme simple or with few short branchlets towards the base, triquetrous, scabrous, with rather few branch setae, the spikelets mostly binate on scabrous pedicels 0.5–1 mm long with discoid apices. Spikelets pale greenish, about 6 mm long, elliptical, slightly and very shortly rounded to constricted at the base or subsessile, usually long-awned, not very turgid, the glumes and lower lemma membranous-herbaceous. Lower glume one-half to two-thirds as long as the spikelet, acute to acuminate, 5-nerved, scabrous on the nerves and very lightly scabrous between them, embracing the base of the spikelet, very slightly inflated above the extremely shortly constricted base. Upper glume as long as the spikelet and similar in outline, 5- to 7-nerved, convex on the back, acuminate to long-caudate or tapering into an awn up to 1 cm in length, lightly scabrous, scabrous-spinulose on the nerves with the spinules scarcely exceeding 0.3 mm in length. Lower floret staminate: lemma similar to the upper glume in outline but flat or lightly depressed on the back, 7-nerved, tapering into a scabrous awn 2–9 cm long, scabrous-spinulose on the nerves with the spinules rarely exceeding 0.4 mm in length, rather lightly scabrous between the nerves; palea oblong, rather broad, hyaline, almost as long as the lemma. Anthers (2–) 2.5–2.8 mm long, bright orange-yellow. Upper floret hermaphrodite, elliptical, 4.5–5 mm long including the short caudate tip, smooth, shining, planoconvex: lemma thinly crustaceous, convex on the back, tapering gradually into and slightly scabrous towards the scabrous tip, obscurely 5-nerved, lightly and obscurely striolate; palea similar to the lemma in texture and almost as long but flat on the back, the broadly curving sides thinner towards the margins and slightly broader towards the base, embracing the grain. Grain elliptical-oblong, 3.0–3.1 mm long and 1.75–1.9 mm broad, whitish to pale brownish, somewhat flattened and not very turgid, the embryo about three-fifths as long.

DISTRIBUTION: Occurs naturally only in swampy areas near the Ord River in Western Australia.

Specimens Examined: Western Australia: herbaceous swamp within sandy savannah country 5 km SSE. of Kununurra (15° 49′ S, 128° 45′ E), common grass in shallow water, *K. Paijmans 2318*, 3.1978 (CANB). Cultivated: Australian Capital Territory: Canberra, cult. from seed from N.W. Australia coll. N. T. Burbidge (CSIRO Accession No. W662), *P. Michael*, 3.1968 (CANB). Japan: cult. from seed from near the Ord River, Kimberley Division, Western Australia coll. N. T. Burbidge (CSIRO Accession No. W662), annual, non-floating ($n = 54$, *T. Yabuno* (K).

This annual species has been examined in detail by Yabuno (1968, 1968a, 1970) who used the seed collected by Dr Burbidge (CSIRO Accession No. W662) as experimental material. In terms of habit, genetic constitution and breeding behaviour he recognized it as distinct from perennial species known as *E. stagnina*. He has shown that it is 12-ploid ($2n = 108$; $x = 9$).

Echinochloa elliptica, *Michael et Vickery*, **sp. nov.**

Gramen annuum usque ad 1.5 m altum. Vaginae tubereulato-setosae. Ligulae plerumque breviter ciliatae. Paniculae erectae contractae fusiformes, usque ad 15 cm longae. Spiculae 4–4.5 mm longae anguste ellipticae stipitatae aristatae. Floseulus inferior neuter. Antherae floseuli superioris 0.75–1 mm longae. Caryopsis albida.

Holotype: Northern Territory: Coastal Plains Research Station, 30 miles SE of Darwin, common on heavy soil banks of rice bays, tufted, erect perennial 3–4 ft high, *M. Lazarides 6805*, 13.3.1963 (CANB 135762). Isotypes: K, NT 22337.

Slender to moderately robust annual up to 1.5 m high, erect or somewhat geniculate and occasionally rooting at the lower nodes, rather light green. Culms simple or branching, compressible, terete or slightly compressed, striate, smooth or subsmooth, about 6-noded. Nodes glabrous. Sheaths mostly longer than the internodes, often rather loose, strongly compressed and keeled upwards, striate, sprinkled with stiff, adpressed or divergent, tubercle-based hairs and otherwise finely pubescent, or glabrous. Ligule finely ciliate at least on the lower and median leaves with the cilia about 1 mm long, the collar often somewhat pubescent. Blades linear, flat, up to 15 cm long, 5–10 mm broad, attenuate to a long-acuminate apex, at the base narrowed rather abruptly into the sheath, lightly or rather closely sprinkled with slender tubercle-based hairs on both surfaces and the lower surface also pubescent, or more or less glabrous, the midrib conspicuous, whitish, with about 7 primary nerves on each side of it, the margins whitish and conspicuously thickened, scabrous and often with a few long, stiff, tubercle-based hairs near the base. Panicle erect, often more or less enclosed at the base in the uppermost sheath, linear, contracted and compact, spindle-shaped, up to 15 cm long, rather dense with numerous short, erect or very narrowly spreading and overlapping branches, the main axis more or less concealed by the branches, striate, terete below, becoming angular-triquetrous above, closely scabrous especially on the ridges and angles, with numerous setae at the nodes; lower racemes up to 4 cm long, the upper diminishing in length upwards, more or less simple, moderately densely clothed on one side with usually binate spikelets, the rhachis triquetrous, scabrous, furnished with moderately numerous branch setae, the pedicels about 0.5–0.75 mm long, scabrous, cupular-discoid at the apices. Spikelets 4–4.5 mm long, 1.5 mm broad, rather narrowly elliptical above a manifestly constricted, about 0.4 mm long, stipe-like base, acuminate, awned, narrowly truncate above the stipe-like base, pale greenish, the glumes and lower lemma membranous-herbaceous. Lower glume usually about half as long as the spikelet, acute to acuminate, 3–5-nerved, scabrous on the nerves and more finely and distantly scabrous between them, embracing and often slightly inflated around the base of the spikelet, rather sharply constricted at the base, often minutely ciliolate on the margins, rarely long-acuminate and almost as long as the spikelet. Upper glume the size and outline of the spikelet, convex on the back, acuminate-caudate or sometimes produced into a short awn up to 10 mm long, 5-nerved, shortly spinulose on the nerves with erect or erectly spreading spinules rarely exceeding 0.3 mm in length, rather sparsely scabrous between the nerves. Lower floret sterile: lemma similar to the upper glume but flat or lightly depressed on the back,

5 (–7)-nerved, shortly spinulose on the nerves with the spinules rarely more than 0.5 mm long, smooth or lightly scabrous between the nerves, attenuate into an awn about 6–30 mm long, or awnless and acuminate; palea hyaline, lanceolate, almost as long as the fertile floret. Upper floret hermaphrodite, rather narrowly elliptical, 3–4 mm long, 1.4 mm broad, smooth and shining, gradually narrowed into a short scabrous cusp: lemma thinly crustaceous, convex on the back, obscurely 5-nerved; palea almost as long as the lemma, similar in texture, flat on the back or somewhat bulging over the mature grain in the middle, the broadly curving sides embracing the grain, thinner towards the margins and broader towards the base. Anthers 0.75–1 mm long, pale to deep yellow. Grain 1.9–2.3 mm long, 1.4 mm wide, oblong-elliptical, whitish, the embryo about three-fifths as long, the margins of the narrow scutellum obscurely differentiated from the endosperm.

Distribution: Occurs in heavy black soil on the plains of Adelaide River, on the Coastal Plain of Northern Territory, and along the Ord River in Western Australia: weedy in experimental rice fields.

Specimens Examined: Northern Territory: Bombing Range, Darwin, *N. Byrnes 2054*, 2.1971 (CANB, NSW, NT); Coastal plain, ½ mile [0.8 km] from E. Cannon Hill Airstrip, black cracking clay soil, *P. Martensz AE765*, 2.1973 (CANB); Bankers Jungle, Koolpinyah, *F. W. Hely H52*, 1943 (CANB); Humpty Doo, black soil plains, *D. Tulloch* 3.1958 (CANB, NT); Humpty Doo—Adelaide River area, in rice fields, *J. D. Moir 22*, 1.1959 (CANB); Humpty Doo, shallow water, *H. S. McKee 8336*, 2.1961 (CANB, K, NSW, NT); Humpty Doo, *S. Aldrick* 2.1971 (CANB, NSW, NT); Humpty Doo, *H. J. Frith* 2.1956 (NSW); Humpty Doo, *W. Poggendorff* 5.1955 (NSW); Outer Litchfield, Humpty Doo, *S. J. J. Davies* 2.1958 (BRI); cult. from soil from Adelaide River, *N. Byrnes 1492*, 2.1969 (NT); Humpty Doo Exp. Rice Farm, growing in 6 in [15 cm] water in rice paddy, 3 ft [0.9 m] high (CANB); Humpty Doo rice fields, robust grass to 5 ft [1.5 m] high, growing on banks of rice bays, *J. Must 650*, 1.1971; Elliott-Lake Woods, *R. A. Perry 278*, 7.1947 (CANB); 20 miles [32 km] SW. of Elliott, *R. A. Perry 270*, 7.1947 (CANB). Western Australia: shallow swamp in plain of Ord River at foot of Wedge Hills, 15 km ENE. of Wyndham, 15° 29′ S, 128° 16′ E, probably subject to occasional brackish flooding in wet season, *K. Paijmans 2275*, 3.1978 (CANB); herbaceous swamp in plain of Ord River, 30 km NW. of Kununurra, 15° 33′ S, 128° 33′ E, grass very common in about 30 cm water, *K. Paijmans* 3.1978 (CANB). Cultivated: Australian Capital Territory: Canberra, cult. from seed collected near Darwin, N.T., *P. Michael* 3.1968 (CANB).

Of the new species described here, *E. elliptica* is perhaps the most distinctive. Its compact, spindle-shaped panicle is unique in the genus. It is the only one of these three presumably native Australian species that has so far shown any weedy propensity.

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A NEW PERENNIAL SPECIES OF *ECHINOCHLOA* FROM NEW GUINEA

P. W. Michael

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ABSTRACT

Michael, P. W. (Department of Agronomy and Horticultural Science, University of Sydney, New South Wales, Australia, 2006) 1980. A new perennial species of Echinochloa *from New Guinea. Telopea 2 (1): 31–33.—Echinochloa praestans* Michael is described and brief observations are made on differences between this species and *E. polystachya* (H.B.K.) Hitchc., *E. stagnina* (Retz.) Beauv., *E. pyramidalis* (Lam.) Hitchc. et Chase and *E. picta* (Koen.) Michael.

J. R. Reeder (1948: 278) noted that plant specimens from New Guinea which he chose to include under *Echinochloa stagnina* (Retz.) Beauv. were more robust than usual for the species. Recent examination of perennial species of *Echinochloa* from much of the sub-tropics and tropics has enabled me to separate plants known as *E. stagnina* in Malesia and Papuasia into three distinct taxa—namely, *E. stagnina* s. str.; *E. picta* (Koen.) Michael in Philippine Journal of Weed Science *5*: 18 (1978); and the species from New Guinea now described.

Echinochloa praestans *Michael*, **sp. nov.**

Gramen perenne saepe fluitans. Culmi erecti robusti usque ad 3.6 m alti. Laminae foliorum summorum usque ad 20 mm latae. Ligulae omnes dense longeque ciliatae. Paniculae usque ad 50 cm longae, ramis scabridis non nisi prope basin setosis. Spiculae 3.5–4 mm longae, ovato-oblongae cuspidatae vel aristatae, glumis et lemmate inferiore praeter nervos breviter paucispinulosos puberulis interdum glabris. Flosculus inferior masculinus.

Holotype: Papua New Guinea: Central Province: c. 3 miles N of Hisin village, Kairuku sub-province on edge of permently inundated swamp in open grassland, alt. 10 ft, up to 2 m tall, local name Nou (Maiva language, Hisiu) *P. J. Darbyshire 815*, 16.8.1962 (CANB 113411). Isotypes: BO, BRI, GH, PNH, US. Parts of the Type Collection (not seen): A, BH, K, L.

Perennial, up to 3.6 m high from long-creeping and copiously rooting rhizomes, more or less aquatic. Culms geniculately ascending, rooting and frequently branching from the submerged nodes, stout, up to 12 mm in diameter, many noded, sheathed throughout or some of the internodes at length exserted, smooth, glabrous. Nodes subglabrous. Sheaths mostly terete, rather loose, smooth to scabrid, usually glabrous, rarely pubescent or silky-hairy at the lower nodes, usually more or less ciliate or bearded at the orifice, the basal often spongy and up to more than 15 cm long. Ligules of all leaves a fringe of rather long stiff hairs up to 5 mm long. Blades linear from a slightly attenuated or rounded base, long tapering to a fine firm point, 30–50 cm long, 10–30 mm broad (uppermost up to 20 mm), flat, firm, glabrous, scabrid to scabrous especially upwards, the thickened whitish margins scabrid to spinulose, the mid-rib conspicuous, whitish, striate and flat above, rounded and rather less conspicuous on the back, up to 3 mm wide at the base, the primary nerves up to 9 on each side and together with the close secondary nerves rather prominent.

Panicle more or less erect, 20–50 cm long, the main axis triquetrous with a flat or convex, smooth or scabrid back, up to 2.5 mm wide, hispidulous or glabrous except at the scabrous angles, usually with nodal setae; branches many, distant or crowded alternate or verticillate, sub-erect, up to 15 cm or more long, often forming stout, dense, 2–4-ranked, simple, secund, false spikes, the lower sometimes devoid of spikelets in the lower half and the short secondary branchlets sometimes remote, the rhachis scabrid about 1 mm wide, setose and villosulous or pubescent only close to the base; pedicels mostly binate, very short, rarely up to 2 mm long, scabrous, discoid at the apices. Spikelets loosely crowded, ovate-oblong, 3.5–4 mm long (excluding the awn if any), mostly pale green, rarely purplish. Glumes membranous-herbaceous, finely puberulous or sometimes glabrous between the shortly spinulose nerves, the rigid spinules of the nerves up to 0.4 mm long, often much shorter. Lower glume broadly angulate-ovate, often ciliate, one third to one half as long as the spikelet, 3–5-nerved, constricted at the base into a short stipe so that the spikelet is narrowly truncate at the base. Upper glume corresponding in outline to the spikelet, convex on the back, caudate-acuminate, 5–9-nerved. Lower floret staminate; lemma similar to the upper glume but flat or depressed on the back, 7-nerved, cuspidate, or often produced into a scabrid awn up to 15 mm long, especially at end of branches and branchlets; palea hyaline, oblong, almost as long as the lemma, with finely scabrous to smooth keels. Upper floret hermaphrodite, broadly elliptical, mucronate-acuminate, about 3.5 mm long, straw-coloured, smooth and shining; lemma crustaceous, with a short scabrous tip, minutely scabrous around the base of the tip; palea similar to the lemma in texture. Anthers mostly 2.0–2.6 mm long, orange-yellow to purplish-brown. Grain oval-oblong, 2–2.5 mm long, about 1.6 mm broad, the embryo about two-thirds as long and rather narrow.

Named on account of its extraordinary stature and in honour of Dr Joyce W. Vickery for her outstanding studies on the taxonomy of grasses in Australia, especially in New South Wales, and with whom I had the privilege of examining *Echinochloa* from all over the world.

Distribution: Along river systems in East Sepik, Western and Central Provinces of Papua New Guinea and in north east West Irian, often forming dense stands in flooded grasslands and swamps. Known only from New Guinea.

Specimens Examined: Papua New Guinea: **East Sepik Province:** Sepik River, Timbunke, Wewak-Angoram area, flooded grassland, *R. G. Robbins 2488*, 9.1959 (CANB); Nauiemba canoe-channel, c. 4 miles [6.4 km] SE of Timbunke, Angoram Sub-province, edge of canal through extensive swampy grassland, alt. 100 ft [33 m] *R. Pullen 1702*, 9.1959 (CANB 70887, 70888, 70889); from Korogo village on Sepik River to Nambi village, Wewak-Angoram area, levee of Sepik, grassland flooded in wet season, *R. G. Robbins 2427*, 9.1959 (CANB); Aibom Barat, Angoram Sub-province (4° 05′ S, 144° 05′ E), swamp, tall grass 12 ft [3.6 m] tall, *A. N. Millar NGF 37538*, 5.1959 (CANB); along Tiyangaram (Black River) S of Ambunti, common in floating grass swamp, alt. c. 150 ft [45 m], local name Kamba (Waskuk), *R. D. Hoogland & L. A. Craven 10.342*, 6.1966 (CANB). **Western Province:** Fly River c. 30 miles [48 km] below Everill Junction, forms pure stands along river banks in water over a fathom [1.8 m] in depth, *L. J. Brass 6585*, 5.1936 (BRI, GH, US); Boset Lagoon, middle Fly River, lagoon margin, long-stemmed floating grass forming an extensive area at edges of open water (7° 15′ S) alt. 20 ft [6 m], *R. Pullen 7380*, 9.1967 (CANB 174865, 174866); Pangoa Airstrip, Lake Murray, Morehead Sub-province (8° 05′ S, 141° 15′ E) alt. 200 ft [60 m], grass in 6 ft [1.8 m] water, *A. N. Millar NGF35413*, 3.1968 (CANB); side of Aramia River, 40 km WNW Balimo Sub-province, alt. 75 ft [22.5 m], frequently flooded swampy sedge grassland, *K. Paijmans 1456*, 5.1972 (CANB). West Irian (Irian Jaya): Bernhard Camp, Idenburg (Taritatu) River, filling deep marshes and lining banks of lagoons on the river plains, rooting on the bottom and floating in dense masses, stems at least 15 m in length, alt. 50 m, *L. J. Brass 13785*, 4.1939 (BO, BRI, BH, US).

Other stout perennial species of *Echinochloa* growing in water, and with prominent ligular cilia, include the American species *E. polystachya* (H.B.K.) Hitchc. and *E. polystachya* var. *spectabilis* (Nees) Martinez Crovetto, and forms of the two African species *E. stagnina* and *E. pyramidalis* (Lamk.) Hitchc. et Chase.

In *E. polystachya* the spikelets are obovate and much longer (up to 7 mm) than in *E. praestans*; in *E. stagnina* the spikelets are elliptical, with a long, acute first glume and strongly echinate with bristles 1 mm long; in *E. pyramidalis* the spikelets

are never awned, smaller than in *E. praestans* and almost glabrous or very finely puberulous. In the American and African species and in the Asian *E. picta*, which is of much shorter stature, scattered setae occur throughout the whole length of the rhachises of the branches of the inflorescence. In *E. picta*, ligular cilia are often poorly developed in the uppermost leaves which are much narrower than those of *E. praestans*. Spikelets are usually narrower and the bristles are much less prominent in *E. praestans* than in *E. picta* which is less dependent on permanent water than *E. stagnina* and *E. praestans*.

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Manuscript received 2.11.1979

THE GENUS *RHYNCHARRHENA* (ASCLEPIADACEAE)

K. L. Wilson

(Accepted for publication 11.9.1979)

ABSTRACT

Wilson, K. L. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. The genus Rhyncharrhena *(Asclepiadaceae). Telopea 2 (1): 35–39.*—The nomenclatural history and the relationships of *Rhyncharrhena* are discussed. The genus is regarded as an Australian endemic and the new combination *R. linearis* (Decne.) K. L. Wilson is made for the single species recognized.

The genus *Rhyncharrhena* F. Muell. was described in 1859 but has since been regarded by most authors as a synonym of *Pentatropis* Wight & Arn. or (erroneously) as a synonym of *Doemia* R. Br. (*Daemia* sphalm. auct.). Even Mueller himself apparently had doubts about its status: he (1882a) accepted the synonymizing of the genus under *Pentatropis* by Bentham (1869) and named a new species *Pentatropis kempeana* F. Muell., at the same time remarking that the species was 'with the other species of this genus readily transferable to *Daemia*.' Later that same year he (Mueller 1882b) transferred to *Doemia* the four species that he recognized. In this he was again following Bentham, who (in Bentham & Hooker 1876) commented that *Pentratropis* (including *Rhyncharrhena*) was scarcely distinct from *Doemia*. However, as pointed out by Brown (1907), *Doemia* R. Br. is a synonym of *Pergularia* L., which is a genus quite distinct from both *Pentatropis* and *Rhyncharrhena*.

The main distinguishing features of these three genera are set out in Table 1. The species of all three are herbaceous twining perennials.

Most Australian Flora-writers up to the present time have used *Pentatropis*, as did Bentham (1869) in Flora Australiensis, although some, e.g. Moore & Betche (1893), have used *Doemia*. The writing of the Flora of Central Australia, under the auspices of the Australian Systematic Botany Society, called for reconsideration of the status of *Rhyncharrhena* and the four species that have been recognized therein.

Such an examination had already been undertaken by the late Dr S. T. Blake in his studies of the family Asclepiadaceae. He concluded that *Rhyncharrhena* deserved recognition as a genus separate from *Pentatropis* and annotated material accordingly in various Australian herbaria, but unfortunately he never published on the subject.

Bullock (1955) gave a resumé of the nomenclatural history of *Pentatropis*, stating that he considered that genus to consist of two species, *P. capensis* (L. f.) Bullock (*P. microphylla* (Roxb.) Wight & Arn.) and *P. spiralis* (Forssk.) Decne., and that 'several Australian species and one from New Guinea . . . should be referred to another genus'. That other genus is *Rhyncharrhena*, as shown by his subsequent comments (Bullock 1965), when he selected *R. atropurpurea* as the lectotype for the genus.

Despite its lack of recognition in Australian Floras, *Rhyncharrhena* seems a well-characterized genus within the Asclepiadaceae, readily distinguished from the Afro-Asian *Pentatropis* by the linear-revolute leaves (as pointed out by Bentham, 1869) and by the form of the corona, as well as by the other characters set out in Table 1. It seems to be confined to Australia, despite Bullock's mention of a New Guinea species of *Rhyncharrhena*. I have seen no specimens of *Pentatropis novoguineensis* Valeton but, from the corona features mentioned in the brief diagnosis given by Valeton (1907), this species belongs in *Pentatropis* rather than in *Rhyncharrhena*, and so has not been considered further here.

As well as reviewing the generic status of *Rhyncharrhena*, it has been necessary to consider specific limits within the genus. Four supposed species that may be assigned to *Rhyncharrhena* have been described: *R. atropurpurea* F. Muell., *R. quinquepartita* F. Muell., *Pentatropis linearis* Decne., and *P. kempeana* F. Muell. These were based on specimens from Queensland, New South Wales, Western Australia, and the Northern Territory respectively, so there has been little attempt by regional Flora-writers to compare them, apart from Black (1957) who considered three of them and then commented that 'better acquaintance with these desert plants may prove that they are forms of a variable species'. Separation of the species of *Rhyncharrhena* has been on the basis of degree of division of the corolla, pubescence of the corolla lobes, follicle size, and slight differences in the corona. These characters (especially the degree of development of the inner corona appendages) do vary slightly in the specimens I have seen, but there is no clear or coherent pattern of variation. I consider this variation to be consistent with what could be expected in a single widespread but scattered species. Vegetatively, specimens from all parts of the range are very similar.

Accordingly, I am treating *Rhyncharrhena* as consisting of one rather variable species, *R. linearis*, which is spread throughout the drier regions of mainland Australia. The necessary specific combination is here made.

All specimens cited have been seen unless otherwise stated.

TABLE 1

Distinguishing features of *Pentatropis*, *Pergularia* and *Rhyncharrhena*.

Feature	*Pentatropis*	*Pergularia*	*Rhyncharrhena*
Leaves ..	ovate with acute or obtuse apex (mucronate); base rounded or subcordate; somewhat fleshy; margins not revolute.	ovate with acute to acuminate apex; base cordate; not fleshy; margins not revolute.	linear to oblong, with acute apex; base long-tapering; not fleshy; margins usually revolute.
Stems	pubescent, becoming glabrous with age.	pubescent, prickly or hispid.	glabrous to minutely pubescent.
Unit infloreseences.	umbel-like; subsessile.	umbel-like to raceme-like; long-peduncuiate.	umbel-like; short-peduncuiate.
Corolla ..	rotate.	salver-form to funnel-form.	broad-campanulate to rotate.
Corolla-lobes ..	puberulous within.	densely pilose within.	glabrous to puberulous within.
Corona ..	single.	double.	double.
Follicle ..	fusiform; glabrous.	ovoid; echinate with long soft bristles.	fusiform; glabrous.
Distribution ..	Africa to Asia and New Guinea.	Africa to Indo-China.	Australia.
Illustrations ..	fig. 1a,b.	fig. 1c,d.	fig. 2a,b.

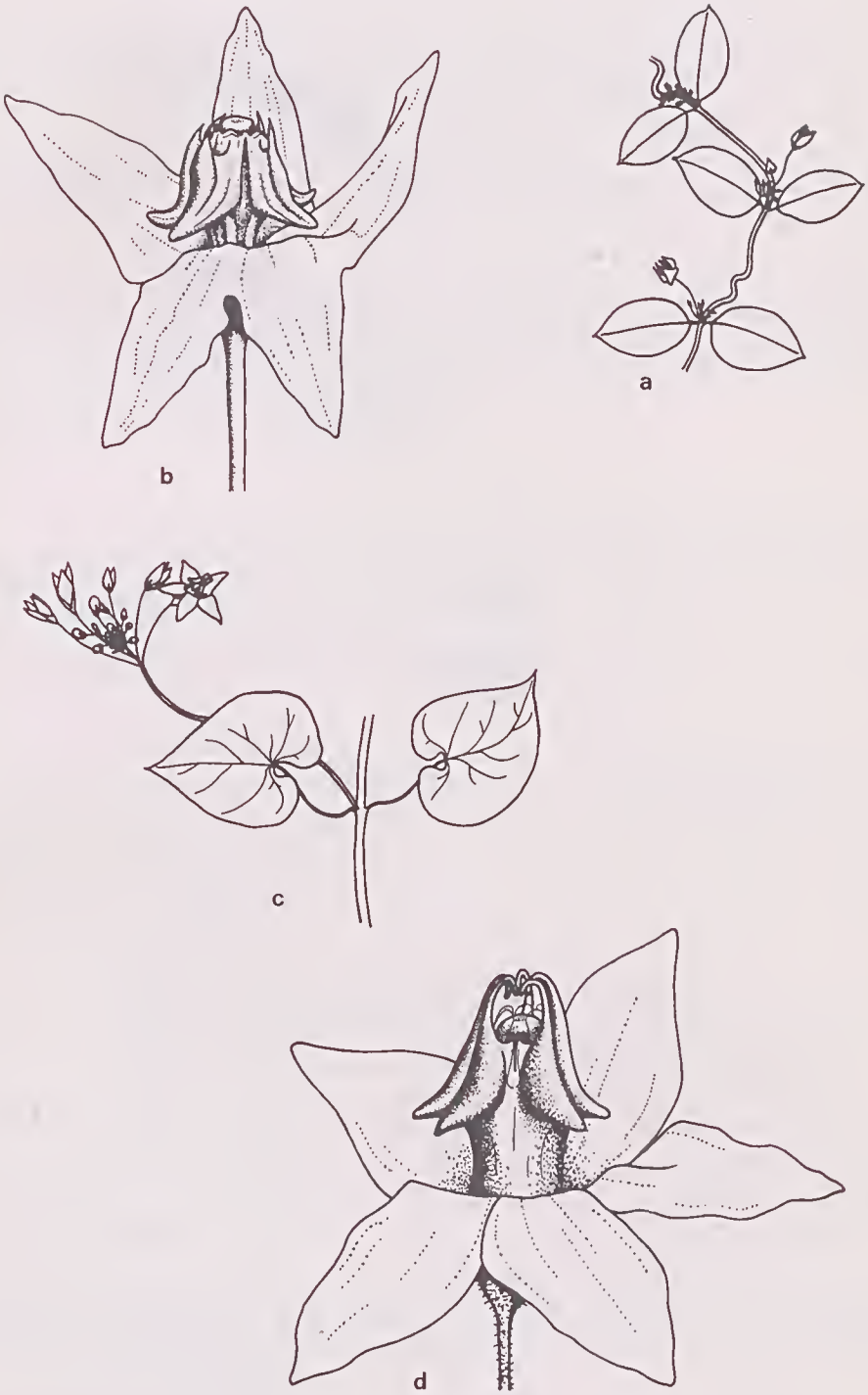

Fig. 1—*Pentatropis capensis* (L. f.) Bullock. (a) Portion of a branch × ⅔; (b) Flower × c. 8; from *Wight 1545*. *Pergularia daemia* (Forssk.) Chiov. (c) Portion of a branch × ¾; (d) Flower × c. 3; from *Scheffler 21*.

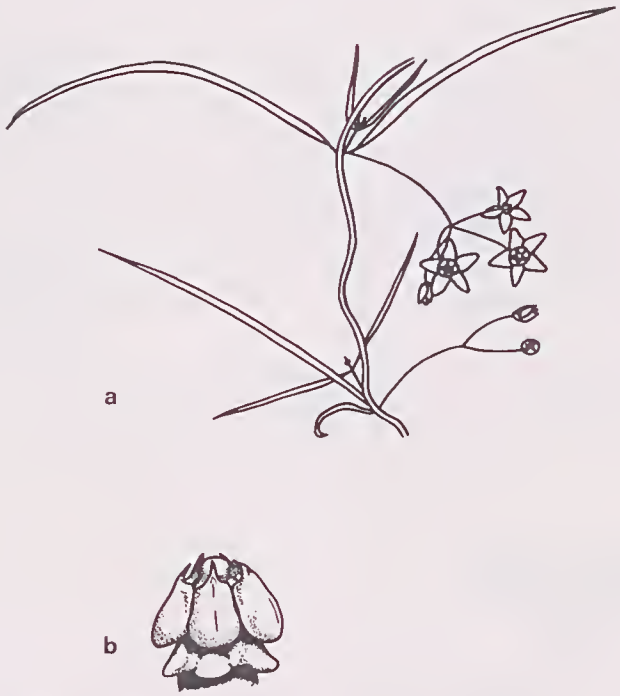

Fig. 2—*Rhyncharrhena linearis* (Decne.) K. L. Wilson. (a) Portion of a braneh × $\frac{2}{3}$; (b) Corona × e. 8; from *McKee 8674*.

Rhyncharrhena linearis (*Decne.*) *K. L. Wilson*, **comb. nov.**

Basionym: *Pentatropis linearis* Decne. in Candolle, Prodr. 8: 536 (1844).

Holotype: Swan River, *Drummond 667* (G—not seen). Isotype: MEL.

Synonymy: *R. atropurpurea* F. Muell., Fragm. 1: 128 (1859).—Holotype: 'in virgultis ad flumina Suttor et Dawson', *Mueller* 11.1856 (MEL 87148).

R. quinquepartita F. Muell., Fragm. 1: 128 (1859).—Holotype: 'in frutieatis [*sic*] deserti ad flumina Murray et Darling', *Dallachy* 10.1858 (MEL 87149).

Pentatropis kempeana F. Muell., S. Sei. Rec. 2: 172 (1882).—Holotype: 'near the Finke River,' *Kempe* 1882 (MEL 87146).

Selected Specimens Seen: Queensland: **Mitchell:** 16 miles [26 km] NW. of Longreach, *Davidson 308*, 12.1952 (BRI); Springvale, *Clemens* 5.1946 (BRI 216825); "Warrillilaba", *Edwards* (BRI 216826). **Warrego:** Charleville, *Silcock S111*, 4.1969 (BRI); 3 km NNW. of "Hillview", *Purdie 6430*, 5.1977 (BRI); "Gilruth Plains", Cunnamulla, *McKee 10342*, 4.1963 (NSW). **Maranoa:** "Bendena", W. of Bollon, *Holland SWQS 1283*, 7.1952 (CANB).

New South Wales: **North Western Plains:** Yathong Nature Reserve, *Canning 3677*, 11.1973 (NSW); Nyngan, *Boorman NSW 143632*, 8.1903 (NSW); Double Peak, *Bäuerlen 3085*, 2.1904 (BRI, NSW). **South Western Plains:** "Morton Court", 1 km W. of Euabalong West, *Cunningham & Milthorpe 5373*, 2.1978 (NSW). **North Far Western Plains:** "Ravendale", NE. of Broken Hill, *Cunningham 733*, 5.1973 (NSW). **South Far Western Plains:** e. 58 km NNW. of Balranald, *Crisp 1731*, 11.1975 (NSW).

Victoria: McCrackens Paddock, 2½ miles [4 km] NNE. of Red Cliffs, *Henshall* 5.1968 (MEL).

Northern Territory: 65 km SSW. of The Granites, *Latz 704*, 7.1970 (BRI, NT); 7 miles [11 km] S. Yuendumu, *Peterson NT 36181*, 4.1972 (NT); Haasts Bluff Reserve, *Cleland* 9.1957 (AD 97215152); Stuart Highway, 53 miles [85 km] N. of Alice Springs, *Nelson 1671*, 4.1968 (NT); Finke R., *Kempe* 1883 (MEL 87145); 2 miles [3 km] ENE. Ayers Rock, *Latz 4121*, 8.1973 (AD, NT); c. 20 km W. of Curtin Springs, *Munir 5120*, 8.1973 (AD).

South Australia: Ernabella, *Tindale & Hackett* 6.1933 (BRI 216827); c. 3 km N. of Carl Dam tank, Commonwealth Hill Station, c. 120 km WNW. of homestead, *Lay 530*, 8.1971 (AD); Malbooma Outstation, c. 1 km S. of Lyons railway siding, *Weber 2754*, 9.1971 (AD); c. 25 km NE. of Maralinga, *Shearer 10*, 2.1972 (AD); Curriewerloo, *Anderson* (BRI 216829); Morroo Mine, c. 20 miles [30 km] W. of Lake Frome, *Greenwood NSW 143629*, 10.1915 (NSW).

Western Australia: 1.5 km N. of Sandy Point Outcamp, Dirk Hartog I, *George 11540*, 9.1972 (PERTH); "Mt Augustus" Station, *Wittwer 1113*, 8.1973 (PERTH); "Woolen", c. 345 km SE. of Carnarvon, *Ashby 2565*, 8.1968 (AD); 14 Mile Creek, Lake Violet, *Bennet* 7.1941 (BRI, PERTH); near White Cliffs HS., E. of Laverton, *George 4533*, 6.1963 (PERTH); near Elder Creek, 2 miles [3 km] W. of Warburton Mission, *George 3926*, 8.1962 (PERTH); 8 miles [13 km] SW. of Three Springs on Encabba road, *Chapman* 10.1978 (PERTH); Coolgardie, *Gardner 1746*, 9.1922 (BRI, PERTH); 3–4 miles [5–6 km] above Northam, *Salasoo 438*, 10.1949 (NSW); Fraser Range, *Helms NSW 143625*, 10.1891 (NSW).

ACKNOWLEDGEMENTS

I am indebted to the Directors of the following herbaria for sending specimens on loan or for making facilities available to me whilst visiting their institutions: AD, BRI, CANB, MEL, NT, PERTH.

Dr Joeelyn Powell kindly made a preliminary examination of specimens in MEL. The figures were drawn by Mr David Mackay.

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Manuscript received 19.7.1979

EUCALYPTUS IMLAYENSIS, A NEW SPECIES FROM A MOUNTAIN OF SOUTH COASTAL NEW SOUTH WALES

M. D. Crisp
AND
M. I. H. Brooker

(Accepted for publication 12.10.1979)

ABSTRACT

Crisp, M. D. (National Botanic Gardens and Herbarium, P.O. Box 158, Canberra City, Australia 2601) and Brooker, M. I. H. (Division of Forest Research, CSIRO, P.O. Box 4008, Canberra City, Australia 2601) 1980. Eucalyptus imlayensis, *a new species from a mountain of south coastal New South Wales. Telopea 2 (1): 41–47, figs 1–3.*— A new species of *Eucalyptus* (Myrtaceae) from Mt Imlay south-west of Eden, New South Wales is described. Its natural affinity, restricted distribution and habitat are discussed. It is considered to have affinity with both mainland Australian and Tasmanian species.

INTRODUCTION

In October 1977 a National Botanic Gardens party of M. D. Crisp, I. R. Telford and J. Pyne discovered, near the summit of Mt Imlay, near Eden, a small population of about 70 mallee eucalypts believed then to have affinity with *E. baeuerlenii* F. Muell. but which were easily distinguished from it and any other known species. When re-examined a few months later, the population was found to be uniform. So also were progeny grown in Canberra from seed collected from the natural population, making hybrid origin unlikely. It was concluded that this population, while extremely small, represented a new species.

Eucalyptus imlayensis *M. D. Crisp et M. I. H. Brooker*, **sp. nov.**

(Figs 1; 2; 3: 1–2.)

Frutex "mallee" ad 7 m altus, cortice laevi; canopio denso, lignotuberum formans; non glaucus. *Cotyledones* bilobae vel reniformes. *Folia plantulae* sessilia, decussata, elliptica vel ovata, 3–6 × 1.5–2.5 cm, viridia vel atrovirentia, leviter crenulata, manifeste glandulifera, nitentia. *Folia adulta* petiolo ad 1.5 cm longo, non-opposita, lanceolata, 10–15 × 1.5–2 cm, crassa, plus minusve erecta, dense reticulata, glandulis obscuris. *Inflorescentiae* axillares pedunculis brevissimis, 3-florae. *Alabastra* ad 0.7 × 0.4 cm; hypanthium obconicum vel sub-urceolatum; operculum conicum vel leviter rostratum. *Ovarium* 3–4 loculare. *Fructus* sessiles vel pedicellis brevissimis, ad 0.7 × 0.7 cm valvas includentes; discus prominens; valvae deltatae, exsertae. *Semina* atro-cinerea vel nigra hilo ventrali.

Holotype: summit of Mt Imlay, 20 km SW of Eden, New South Wales, 37° 11′ S, 149° 44′ E, *M. D. Crisp 4021, I. R. Telford & S. I. Parker*, 16.5.1978, 3 sheets (CBG). Isotypes: A, BISH, FRI, HO, K, L, MEL, NSW.

Fig. 1. *Eucalyptus imlayensis* (foreground) showing individual plants emergent above tall closed heathland.

A *mallee* to 7 m tall; bark smooth, decorticating in broad strips or ribbons, greenish when freshly exposed, weathering through orange-brown to grey; canopy dense, with leaves clustered towards ends of branchlets; forming a lignotuber; non-glaucous. *Cotyledons* bilobed or reniform. *Seedling-leaves* sessile, decussate for many nodes, elliptic to ovate, 3–6 × 1.5–2.5 cm, green to dark green, somewhat glossy, slightly crenulate, prominently glandular including margins; seedling axis square in transection with edges prominently winged and glandular (Fig. 3: 1). *Juvenile leaves* similar though larger, proportionally broader, sessile, green, obtuse, crenulate, sometimes abruptly acuminate. *Intermediate leaves* petiolate, not opposite, broad-lanceolate, ± obscurely crenulate, 6–13 × 1.5–3 cm, green, thick. *Adult leaves* on a short, strongly flattened petiole to 1.5 cm long, not opposite, lanceolate, falcate, 10–15 × 1.5–2 cm, green, thick, held somewhat erect; densely reticulate and with few, minute, non-conspicuous oil glands (Fig. 3: 2). *Inflorescences* axillary on very short peduncles to 0.5 cm long; buds 3, up to 0.7 × 0.4 cm; middle bud shortly pedicellate; lateral buds ± sessile. *Hypanthium* obconical to slightly urceolate; operculum conical or slightly beaked, about equal in length; outer operculum deciduous early. *Staminal filaments* flexuose and most finally inflexed. *Anthers* dorsifixed, cuneate to oblong in outline, opening in longitudinal slits, 0.5 mm long. *Ovary chambers* 3 or 4. *Ovules* in 4 vertical rows. *Fruit* sessile to very shortly pedicellate, up to 0.7 × 0.7 cm including valves; hypanthium cupular to sub-campanulate; disc prominent, convex; valves deltoid, exserted. *Seed* dark grey to black, almost smooth, somewhat furrowed on the dorsal side; hilum ventral with slightly raised ridges radiating from it.

Distribution: known only from Mt Imlay, SW. of Eden, South Coast, New South Wales, where it occurs just below the summit on the E. side, at 800 m altitude.

Specimens Examined: New South Wales: South Coast: summit of Mt Imlay, 20 km SW. of Eden, *M. D. Crisp 3502 & I. R. Telford*, 25.10.1977 (CBG, FRI, K, L, MEL, NSW); ibid., *M. D. Crisp 4022–4*, *I. R. Telford & S. I. Parker*, 16.5.1978 (CBG, FRI, NSW); ibid., *M. I. H. Brooker 6018–22*, 2.11.1978 (FRI). Cultivated: Australian Capital Territory: National Botanic Gardens, seedling ex *Crisp 4021*, *M. D. Crisp 5668*, 19.2.1979 (CBG, NSW); Division of Forest Research, CSIRO, seedlings ex *Brooker 6018*, 13.6.1979 (FRI).

AFFINITY

The bud, fruit and seedling morphology of *E. imlayensis* place it in series *Viminales* (Pryor & Johnson, 1971). We believe it has some characters in common both with subseries *Vernicosinae* and with subseries *Viminalinae*. In the morphology of the buds and the shape, colour and thickness of the adult leaves, *E. imlayensis* resembles *E. suberenulata* Maiden & Blakely but the fruits have an ascending disc like that in *E. viminalis*. All three species have buds in 3's.

The seedlings of *E. imlayensis* can be distinguished from species in subseries *Viminalinae* by their unique combination of elliptic to ovate, obtuse leaves with crenulate margins, green (not dull) colour and winged axis (Fig. 3: 1). The lack of conspicuous oil glands in the fresh adult leaf of *E. imlayensis* is shared to some extent in the subseries only with *E. macarthurii* Deane et Maiden (Fig. 3: 2, 4–9). Five stands of *E. macarthurii* cultivated in Canberra were examined. One of these showed adult leaves with a few oil glands visible near the midrib. In general, species of the *Viminalinae* have conspicuous oil glands in the leaves e.g., *E. smithii*, *E. badjensis*, *E. viminalis* and *E. baeuerlenii* (Fig. 3: 5, 6, 7, 8, 9). The strongly developed secondary (outer) intramarginal vein of *E. imlayensis* (Fig. 3: 2) is not seen at all in subseries *Viminalinae*, except sometimes very weakly in *E. viminalis* Labill., e.g. in material from Cotter, Australian Capital Territory (Fig. 3: 7). Specimens of *E. viminalis* from Bendoc, Victoria and near Hobart, Tasmania (Fig. 3: 8) did not show this character.

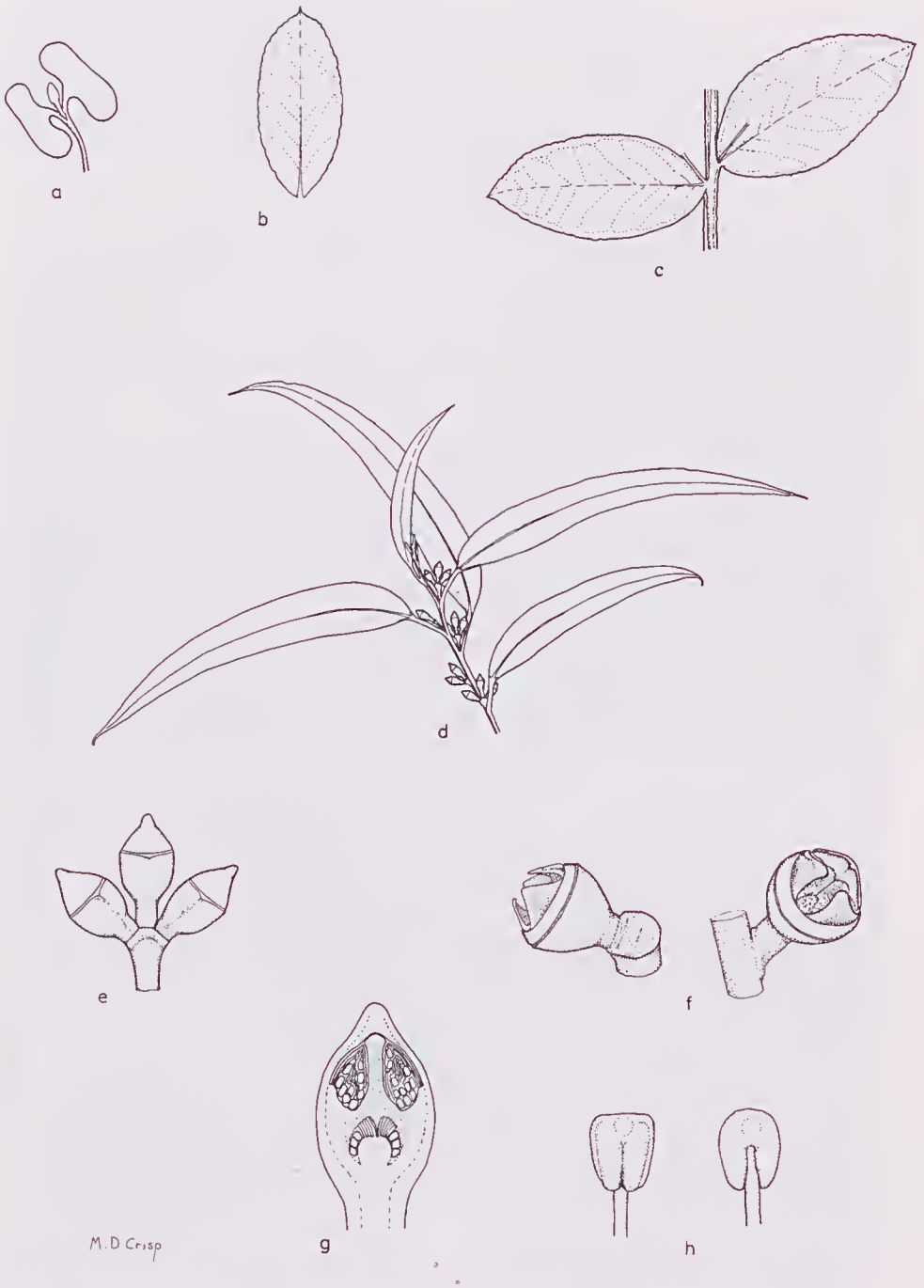


Fig. 2. *Eucalyptus imlayensis* M. D. Crisp et M. I. H. Brooker a. cotyledons, × 3. b. coppice leaf, × 0.5. c. seedling leaves, 17th pair, × 0.5. d. adult leaves with immature buds, × 0.35. e. mature buds, × 2. f. fruits, × 2. g. bud in median longisection, × 3.5. h. anthers in ventral (l.h.s.) and dorsal (r.h.s.) view, × 20. (a, d & f from *Crisp 4021*; b from *Crisp 4023*; c from *Crisp 5668*; e & h from *Crisp 3502*; g from *Crisp 4024*).

In habit and habitat *E. imlayensis* has a superficial resemblance to *E. baeuerlenii* which is a disjunctly distributed mallee with the nearest occurrence on Sugarloaf Mt, 200 km north of Mt Imlay. However, *E. baeuerlenii* differs in its narrower, grey-green seedling and juvenile leaves, wingless seedling stem, larger fruits, and buds with the operculum abruptly acuminate.

Seedlings of species in the subseries *Vernicosinae*, e.g. *E. johnstonii* (Fig. 3: 3), are somewhat similar to those of *E. imlayensis*, but the leaves of the former are yellow-green and orbicular, and the stems square in transection but not winged. In the adult leaves there is an abundance of clearly visible oil glands, and the venation is coarser, more irregular, and lacks a definite secondary intramarginal vein.

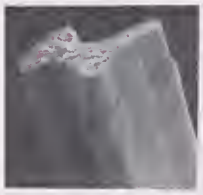
Eucalyptus imlayensis cannot be certainly placed in either the *Vernicosinae* or the *Viminalinae*. It may constitute a link between them though we prefer to place it in the *Vernicosinae* apart from the true yellow gums (*E. vernicosa* Hook. f. *sens. lat.*). We therefore suggest the code SPIJI.

The only eucalypts directly associated with the population of the new species are a few *E. sieberi* L. A. S. Johnson, mostly in mallee form. Immediately below the population is a pure stand of *E. fraxinoides* Deane et Maiden, and surrounding it on the other three sides is *E. sieberi* again in mallee form. Hence, *E. imlayensis* is isolated from the nearest species of section *Maidenaria* viz. *E. smithii* R. T. Baker which occurs deep in gullies on the opposite (western) aspect of the peak. Species within the same section might be expected to be genetically compatible but there is no evidence of hybridisation. Further, the buds of the *E. smithii* are consistently in 7's, and the leaves have clearly visible oil glands. The uniformity of the *E. imlayensis* population in the field, and of its glasshouse-grown progeny, suggest that it is very unlikely to have had a hybrid origin.

ECOLOGY

Mt Imlay is an isolated massive mountain, rising to nearly 900 m above sea level. The population of *E. imlayensis* is small. There are about 70 individuals, mostly in a small amphitheatre of about 1 ha just below the summit, with a few individuals slightly further away (K. Margus, personal communication). The site is a very steep quartzite outcrop with an easterly aspect. It receives a great deal of moisture, especially in the form of orographic cloud. Underneath the open eucalypt canopy is a tall closed heathland dominated by *Monotoca ? scoparia* (Sm.) R. Br., *Leptospermum lanigerum* (Ait.) Sm. and *Oxylobium ellipticum* (Labill.) R. Br., with *Eriostemon virgatus* Hook. f., *Prostanthera walteri* F. Muell. and *Leptomeria acida* R. Br. also common (Fig. 1). It is worth noting that *Eucalyptus vernicosa sens. lat.* occurs on similar quartzite or schist mountain-tops in Tasmania where it is emergent in heathland dominated by *Monotoca*, *Eriostemon virgatus* etc. (A. Gray, personal communication). In fact, Mt Imlay is one of the only two known Australian mainland locations of *E. virgatus*. The other is on Mt Kaye in East Gippsland, Victoria. Apparently Mt Imlay has much in common biogeographically with Tasmanian peaks such as the Sentinel Range, and those near the Great Lake.

An adjacent high ridge on the South Coast of New South Wales (Letts Mt) lacks similar heath; certainly no *E. imlayensis* was found there. Mr N. Scarlett kindly searched through material of related species in MEL for any collection of the new species from eastern Victoria, but found none.



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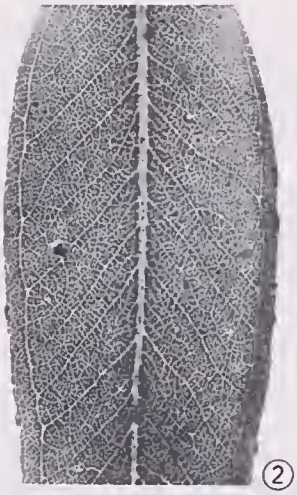

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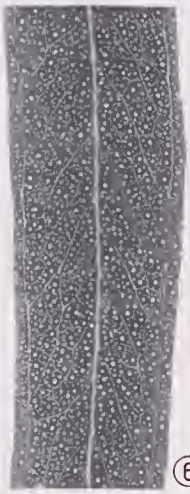

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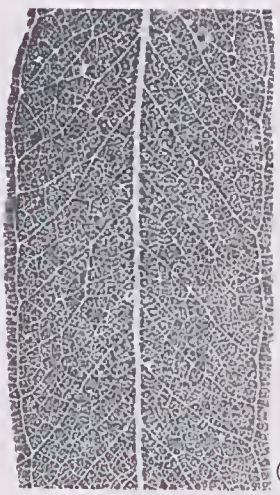

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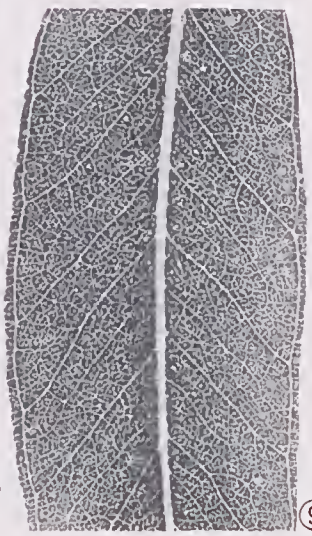

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All the plants of *E. imlayensis* have large lignotubers moulded around and between the quartzite rocks amongst which they grow. Apparently they are very old. Perhaps the population is a tiny remnant of a species declining towards extinction, due to a lack of other suitable sites or the opportunity to exploit them. It is possibly the rarest species in the genus, and must be regarded as endangered and requiring regular monitoring. Mt Imlay is in a National Park, but this alone is no guarantee of preservation. Recently two developments proposed for the summit were averted, principally because of the discovery of *Eucalyptus imlayensis*.

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Manuscript received 12.7.1979

Fig. 3: 1. *Eucalyptus imlayensis* M. D. Crisp et M. I. H. Brooker—transection of seedling stem under S.E.M., × 8. 2–9. Fresh adult leaves illuminated by transmitted light, × c. 2.5. 2. *E. imlayensis*. 3. *E. johnstonii* Maiden. 4. *E. macarthurii* Deane et Maiden. 5. *E. smithii* R. T. Baker. 6. *E. badjensis* de Beuzeville et Welch. 7. *E. viminalis* Labill. from Cotter, Australian Capital Territory. 8. *E. viminalis* from near Hobart, Tasmania. 9. *E. baeuerlenii* F. Muell.

LOMANDRA TROPICA (XANTHORRHOEACEAE*) A NEW SPECIES FROM NORTHERN AUSTRALIA

ALMA T. LEE

(Accepted for publication 4.12.1979)

ABSTRACT

Lee, Alma T. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. Lomandra tropica (*Xanthorrhoeaceae*)—*a new species from northern Australia. Telopea 2 (1): 49–53.*—*L. tropica*, with subspecies *tropica* and *arnhemica*, closely related to the *L. glauca* group (Section *Cephalogyne*), is described. The species extends from the Kimberley region of Western Australia to the Arnhem coast of Northern Territory.

Recent collecting in less accessible parts of northern Australia has clarified the identity of two old and previously puzzling specimens at NSW. One of the latter is almost certainly (? a part of) the collection recorded as *Xerotes elongata* by Fitzgerald (1916/17: 127) in Botany of the Kimberleys [it bears a recognized Fitzgerald field label, a stamp: 'received 22.9.1910', the name '*Xerotes elongata*', and 'loc . . . W.A.']. The second specimen is undoubtedly (? a part of) the material on which Mueller (1892: 475) based his record of "*Xerotes Brownii*" F.v.M. from "Welcome Creek" [its blue Phytologic Museum of Melbourne label has '*Xerotes Brownii*, Welcome Creek, *Bradshaw & Allen*, 1891'; the specimen, presented by the Linnean Society of New South Wales, reached NSW on 7.11.1924. Mr Joseph Bradshaw organised the expedition, to the Prince Regent River, and Allen was the collector].

It is now clear that these two specimens, their corresponding records, and the recent collections are all referable to a tropical taxon closely related to *L. glauca*. More than twenty collections were available for study, and the nature and range of the taxon are becoming evident. It is manifestly a part of the *L. glauca* group of species and is divisible into two subspecies. Some specimens of the eastern race are scarcely separable from *L. glauca* subsp. *collina*, though the larger leaves of the western subspecies distinguish it readily from the latter taxon. The distinctions (from *L. glauca*) common to both subspecies are few and somewhat esoteric, but, together with the great spatial disjunction from all other parts of the complex, make treatment at species level appropriate. Moreover, recognition of the two geographic races as subspecies in *L. tropica* is compatible with the infraspecific division adopted in *L. glauca*.

Lomandra tropica *A. Lee*, **sp. nov.**

Species duarum subspecierum affinis *L. glaucae* praesertim subsp. *collinae*, sed floribus masculis flavis postea denigricantibus et foliis plerumque longioribus et plus complanatis; autumno florens.

Caules caespitosi sed quisque ad c. 10 cm extendens; folia glauca plana ad concavo-convexa (19–) 25–45 (–55) cm longa, 0.3–3.5 mm lata, tenuissima in regionibus orientalibus, latiora occidentalibus, apice acuta vel acuminata, margine laevia vel scabridiuscula. Foliorum basium margines membranacei sursum gradatim angustiores, mox in fibras pallidas lacerati. Flores feminei in capitulo fere sessile, ad 1.5 cm diam. Inflorescentia mascula cum pedunculo ad 25 cm longa, ramis pluribus, floribus in fasciculis sessilibus.

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* The Family to which *Lomandra* and related genera should be referred has been and is still the subject of investigation. Its placement here, in Xanthorrhoeaceae, follows the system adopted in NSW and is not an expression of informed opinion. A summary of treatments accorded these genera (tribe *Xeroteae* Bentham), as a result of special-discipline investigations, is given in Stevens (1978).

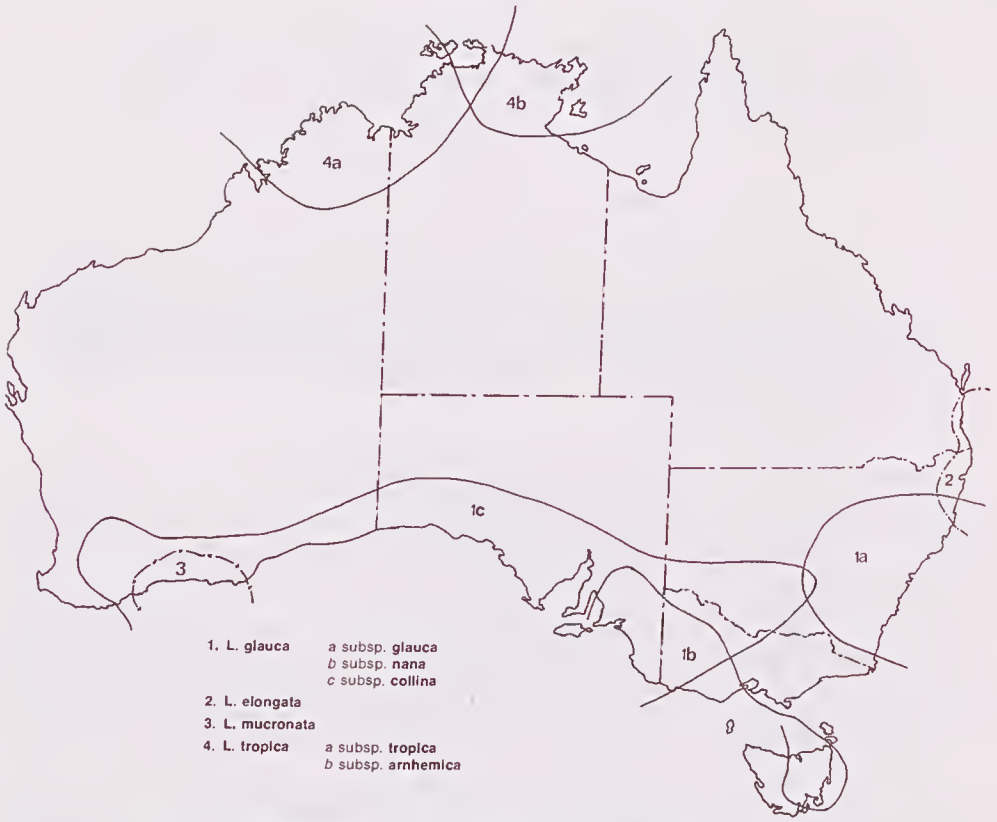

Fig. 1. Distribution of *L. tropica* and the *L. glauca* group.

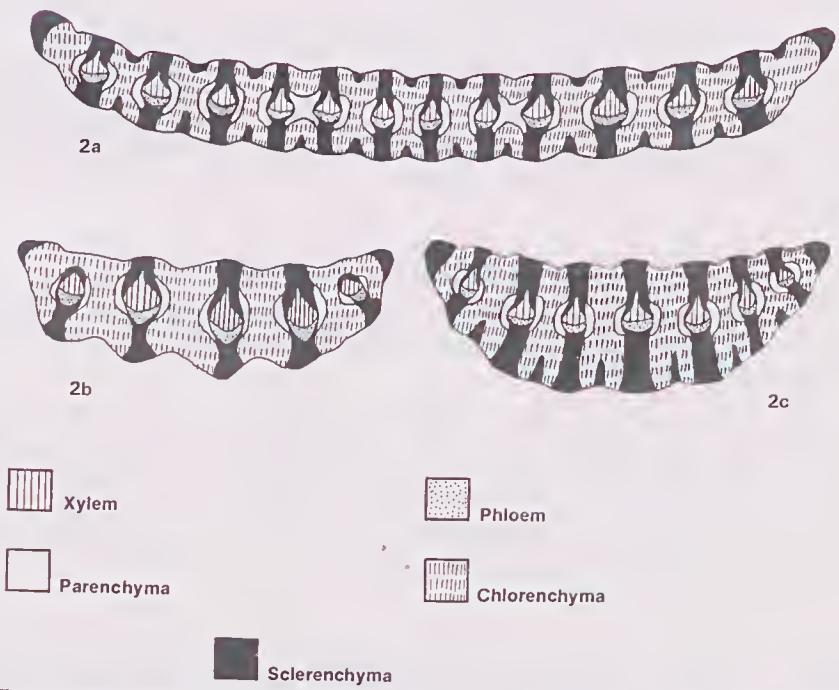

Fig. 2. Transverse section of leaf—2a *L. tropica* subsp. *tropica*, × c. 60; 2b subsp. *arnhemica* (an exceptionally narrow leaf), × c. 250; 2c *L. glauca* subsp. *collina*, × c. 150.

HOLOTYPE: WESTERN AUSTRALIA: **Northern Province—Gardner***: Welcome Creek [vicinity of Prince Regent R.], *Bradshaw & Allen NSW 50574*, 1891 (NSW ♂).

Perennial tussocky plants branching near ground level, the individual shoots of the clump less than 1 cm in diameter, often 6–8 mm, commonly extending to 8–12 cm in length. *Leaves* glaucous, drying pale green or greyish green, narrow-linear (19–) 25–45 (–55) cm long, from 0.3 mm broad (in eastern parts of the range) to 3.5 mm (in western parts), flat when wider or slightly concavo-convex when very narrow, the margins minutely scabrid or quite smooth, the apex acute to acuminate with an apical triangle 1–3 (–4) mm high [see Lee (1972: 253, Fig. 1)]; membranous margins of the leaf bases pale or with some rusty coloration, gradually narrowed upwards, at first intact then finely lacerate (as in *L. glauca* subsp. *collina*). *Male inflorescence* several-branched with sessile flower clusters, its peduncle with rare exceptions clearly exposed above the leaf bases (by up to 12 cm) and slightly flattened; *female inflorescence* capitate, c. 1.5 cm in diameter, the peduncle short and scarcely exposed above the leaf bases. *Male flowers* yellow at first, later purplish black, c. 2 mm long, the perianth segments joined for half their length, the free limbs of the outer segments slightly broader than and just overlapping those of the inner, the anthers sessile on the segments where thickening of the tissue suggests fusion with filaments. *Female flowers* rather longer, c. 5 mm, the ovary trilocular with a very short style and trifid stigma; *capsule* c. 8 mm long, the lower part wrinkled within the persistent perianth, almost smooth above, loculicidal, 3-ovulate and 3-seeded or often 1-seeded with two aborted ovules. *Seed* obovoid, attached to a central placenta near the base of the carpel, the micropyle adaxial near the seed's equator, when dry the testa glistening between slightly raised reticulae, when soaked almost smooth.

DISTRIBUTION (see fig. 1): tropical Australia from the Kimberley region of Western Australia to Arnhem Land and Groote Eylandt in the Northern Territory, north of lat. 17° S.

The species shows division, with some intergradation, into eastern and western races, treated here as subspecies.

Key to the Subspecies and a Related Taxon

1. Floral bracts pale, not discolouring markedly with age; flowers yellow, the perianth darkening to purplish black at or after anthesis; leaves flat to (slightly) concavo-convex, very fine to 3.5 mm broad, (19–) 25–45 (–55) cm long; leaf breadth: thickness ≥ 4:1, the chlorenchyma bands broad and ± X-shaped in T.S. (Fig. 2a, 2b). Tropical Australia from Western Australia (Kimberley) to Northern Territory (Gulf of Carpentaria). Flowering in Autumn ..... *L. tropica*
   a. Leaves long and broad so that plants appear coarse: leaves (1–) 2–2.5 (–3.5) mm broad; western part of the range ..... subsp. *tropica*
   b. Leaves long and narrow so that plants appear less dense: leaves 0.3–1.75 mm broad; eastern part of the range ..... subsp. *arnhemica*

1.* Floral bracts pale, becoming chestnut brown with age; flowers yellow, the perianth not darkening after anthesis; leaves usually distinctly plano-convex, (0.25–) 0.6–1.3 mm broad, (3–) 10–25 (–50) cm long; leaf breadth: thickness ≷ 3:1, the chlorenchyma bands narrower and ± inverted Y-shaped in T.S. (Fig. 2e). Southern Australia from south-west of Western Australia to western New South Wales. Flowering in Spring ..... *L. glauca* subsp. *collina*

a. L. tropica subsp. tropica

[*Xerotes elongata* sensu auct. non Benth.: W. V. Fitzgerald, J. & Proc. Roy. Soc. Western Australia 3: 127 (1916/7)].

["*Xerotes Brownii* F.v.M." sensu F. Mueller, Proc. Linn. Soc. New South Wales (Ser. 2) 6: 475 (1892)].

Diagnostic characters as given in the key.

* From Beard (1979)

DISTRIBUTION: Western part of the species' range—in the Western Australian Kimberley region extending eastward into the western part of the Darwin and Gulf District (Northern Territory); in sandy soils (recorded sometimes as 'granitic', 'red soil over laterite', 'on bauxite') of plateau or river bank, in palm and eucalypt woodland.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: **Northern Province—Gardner:** Mitchell Plateau airfield, 14° 48′ S, 125° 48′ E, *Kenneally 7019*, 2.1979 (PERTH); Mitchell Plateau, W. Kimberley, palm woodland area on bauxite, *Kenneally 4901*, 6.1976 (PERTH); Mitchell Plateau, NW. Kimberley, palm woodland area on laterite, *Kenneally 4902*, 6.1976 (PERTH); near Dromaius Ck, Drysdale R. Natl. Park, c. 15° 16′ S, 126° 43′ E, *George s.n.*, 8.1975 (PERTH); Blyxa Ck, Prince Regent River Reserve, 15° 48′ S, 125° 20′ E, *George 12441*, 8.1974 (PERTH); Welcome Ck [vicinity Prince Regent R.], *Bradshaw & Allen NSW 50574*, 1891 (NSW); "Gibb R." near homestead, *Johnson 2089*, 8.1967 (NSW ♀); Isdell R.—base of Mts Rason & Daglish, of Tabletop Mtn—Calder R., *Fitzgerald NSW 81629*, recd. 9.1910 (NSW).

NORTHERN TERRITORY: **Darwin & Gulf District*:** "Munmalary Station", 12° 14′ S, 132° 35′ E, *Latz 3775*, 5.1973 (NSW); Pine Creek, *Byrnes 1322*, 1.1969 (DNA, K); Moyle R., Port Keats, *Robinson DNA 5132*, 9.1972 (DNA).

b. L. tropica subsp. **arnhemica** *A. Lee*, **subsp. nov.**

A subsp. *tropica* foliis angustioribus differt etsi crassitudine similibus.

HOLOTYPE: NORTHERN TERRITORY: **Darwin & Gulf District:** 113 km W. of Giddy R. crossing, 12° 22′ S, 136° 42′ E, *Symon 7751*, 6.1972 (NSW ♂ & ♀).

Diagnostic characters as given in the key.

DISTRIBUTION: eastern part of the species' range: in central and eastern Darwin & Gulf District, on sandy soil ('in open eucalypt forest', 'edge of sandy swamp area') from near sea level to top of the Arnhem plateau.

SPECIMENS EXAMINED: NORTHERN TERRITORY: **Darwin & Gulf District:** Elcho I., 11° 59′ S, 135° 43′ E, *Latz 6072*, 7.1975 (DNA, NSW); East Alligator R., 1 mile [1.6 km] E. of crossing, 12° 24′ S, 133° 01′ E, *Byrnes 825*, 5.1968 (DNA); approx. 4 miles [c. 6 km] E. of Mary R., Oenpelli road, *Byrnes 785*, 5.1968 (DNA); Kapalga, Ref. 0918, 12° 36′ S, 132° 25′ E, *Collins 232*, 2.1977 (DNA); Jabiru, 12° 40′ S, 132° 50′ E, *Dunlop 3282*, 2.1973 (DNA); Nourlangie Rock, 12° 52′ S, 132° 47′ E, *Fox 479*, 6.1974 (DNA); Mt Brockman, 12° 45′ S, 132° 57′ E, *Barnett & Azzopardi 11*, 2.1977 (DNA); Caledon Bay, *Byrnes 971*, 10.1968 (DNA); Sleisbeck, 13° 47′ S, 132° 49′ E, *Byrnes 1650*, 6.1969 (DNA); Alyangula, Groote Eylandt, 13° 51′ S, 136° 25′ E, *Levitt 308*, 6.1973 (DNA); 16 miles [26 km] N. of Wilton R. crossing, *Byrnes 2624*, 6.1972 (DNA).

This species differs from *L. glauca* (all subspecies) in its usually longer and broader inflorescence on a longer peduncle exceeding the overlapping bases of the leaves. Subsp. *tropica* is clearly distinct from all of *L. glauca*, but some specimens of subsp. *arnhemica* with relatively short peduncles are very similar to *L. glauca* subsp. *collina*. There is little to separate such plants other than their locality, though the leaf form (in a fresh or soaked out T.S.) appears to be distinctive (Fig. 2b, c): broad in relation to thickness and flat (or slightly concavo-convex in the narrowest leaves) with fewer veins per unit of width in *L. tropica* subsp. *arnhemica*, narrower in relation to thickness and plano-convex with more numerous veins in *L. glauca* subsp. *collina*. The blackening older flowers with pale bracts in *L. tropica* are shown in almost all the specimens where male flowers are present, while persistent yellow flower colour with brown bracts obtains in *L. glauca*; these characters will serve to separate most collections. Finally a Spring flowering indicates *L. glauca*, while *L. tropica* flowers in Autumn.

* From Chippendale, G.M. (1971: 209).

ACKNOWLEDGMENTS

This work has been greatly facilitated by loans of specimens from the Western Australian Herbarium (PERTH) and the Darwin Herbarium (DNA), assistance which I am happy to acknowledge here. The figures were prepared for publication by R. Roden.

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Manuscript received 12.10.1979

PIMELEA ELONGATA (THYMELAEACEAE) A NEW SPECIES FROM INLAND AUSTRALIA

Susan Threlfall

(Accepted for publication 4.12.1979)

ABSTRACT

Threlfall, Susan (John Ray Herbarium, University of Sydney, Australia, 2006) 1980. Pimelea elongata (*Thymelaeaceae*) *A new species from inland Australia. Telopea 2 (1): 55–56.—Pimelea elongata* Threlfall, sp. nov. occurs in inland areas of eastern central Australia and has some significance as a stock poison in some areas. It has been referred to as *P. trichostachya* Lindl. form "B" by Everist (1974), 'Poisonous Plants of Australia'.

INTRODUCTION

I have prepared a revision of the eastern Australian species of *Pimelea* as part of the requirement for a Ph. D. degree at the University of Sydney. I hope to publish this but in the mean time a name is required for one of the undescribed species occurring in the area of the proposed Central Australian Flora. This contribution supplies that name.

Pimelea elongata *Threlfall*, sp. nov.

Planta gracilis erecta ad 50 cm alta caulibus fuscis. Folia alterna, flavo-viridia, lineari-elliptica. Flores in spicis interruptis disposita sine involucro. Perianthium flavo-viride pilis brevis antrorsis vel antrorso-appressis instructum.

Holotype: Tributary of Beechel Creek, 3 miles (5 km) NW. of Cheepie, Queensland, *Clark*, 22.7.1970 (BRI 100000).

Slender erect plant up to 0.5 cm high, mainly herbaceous but woody at the base. *Stems* yellow-brown, bearing scattered hairs which become fewer with age. *Leaves* alternate, yellow-green, sometimes blue-green when dry, linear-elliptic, 3–15 mm long, 0.8–2.5 mm wide, acute, glabrous or bearing scattered hairs on both surfaces, with the midrib not prominent, concave, convex or flat; petiole 0.5–1.0 mm long. *Spikes* terminal; peduncle up to 16 mm long at maturity, covered with scattered hairs. *Involucre* absent, but a pair of stem leaves close under the inflorescence in the bud. *Spikes* condensed when young but elongating to up to 15 cm at maturity, interrupted; rachis more densely hairy than the stem. Flowers bisexual. Pedicels 0.5–1.5 mm long, covered with scattered patent hairs. *Perianth* yellow-green, 3.5–5.0 mm long, glabrous inside, densely covered outside with short antrorse hairs which become appressed on the lobes; tube 2.8–4.0 mm long, constricted at the neck, circumcissile above the ovary after flowering; lobes elliptical, 0.5–1.0 mm long, 0.3–0.8 mm wide, obtuse, glabrous, towards the margins on the outer surface. *Stamens* inserted in the mouth of the tube and exceeding it; filaments shorter than the perianth lobes, 0.1–0.2 mm long; anther cells oblong, 0.3–0.8 mm long, up to 0.3 mm wide, usually on a narrow connective and back to back when dehisced but sometimes on a broad connective and parallel and introrse. *Ovary* depressed-ovoid, 1–2 mm long, 0.5–0.8 mm wide, glabrous except for a tuft of hairs at the apex, sessile; style 1 mm long; stigma papillose. *Mature fruit* green, glabrous except for a few hairs at the apex, ovoid, 2.5–3.0 mm long, 0.8–1.0 mm wide, enclosed in the persistent base of the perianth. *Seed* ovoid or slightly pear-shaped, 2.5–3.0 mm long, 0.8–1.0 mm wide, glabrous, black, foveate with the pits in rows.

DISTRIBUTION: Western New South Wales, south western Queensland, north eastern South Australia and southern Northern Territory.

HABITAT: On heavy textured soils with a thin sandy upper layer.

SPECIMENS EXAMINED: QUEENSLAND: "Springfield", Windorah, 5 miles [8 km] W. of Thylungra Homestead, Stranger, 28.8.1959 (BRI 019515); Munberry, Cheepie, *Clark*, 18.2.1971 (BRI 109463); 104 miles [166 km] from Charleville on Quilpie Road, *Everist*, 1.9.1963 (BRI 062038); Warrego District near Toompie, *Everist*, 20.4.1968 (BRI 158130).

NEW SOUTH WALES: Walgett, *Guilfoyle*, 30.5.1901 (MEL); Bourke, *Hatten*, 4.1900 (NSW 128570).

SOUTH AUSTRALIA: Areoona Creek (Mt Searle to Yankannina Road, 60 km E. of Leigh Creek), *Rohrlach*, 10.10.1959 (AD 96046059); Chambers Gorge (60 km ENE. of Blinman), *Eichler 12573*, 12.9.1956 (NSW).

This species is discussed in Everist (1974: 495) as *P. trichostachya* Lindl. 'Form B'.

P. elongata belongs to a group of species in which the individuals are relatively short-lived with small yellowish flowers. The group as a whole occurs in the drier inland parts of eastern-central Australia, often in fairly large stands. They are all poisonous to stock and are sometimes difficult to distinguish.

Key to *Pimelea elongata* and related species

A. Spikes dense and uninterrupted, usually elongating up to 2.5 cm in fruiting stage.

B. Pedicel hairs 1–1.5 mm long. Perianth with short antrorse hairs. Stems reddish at the base. Peduncle up to 17 mm long. Spikes condensed or elongated at maturity. ..... *P. simplex* F. Muell.

B.* Pedicel hairs short (0.3–0.6 mm long). Perianth with fine patent hairs which become coarser and appressed on the lobes. Peduncle up to 35 mm long. Spikes elongated at maturity..... *P. continua* J. M. Black

A.* Spikes interrupted, elongating to over 10 cm in fruiting stage.

C. Perianth-tube with short antrorse hairs ..... *P. elongata* Threlfall

C.* Perianth-tube with long patent hairs ..... *P. trichostachya* Lindl.

ACKNOWLEDGEMENTS

I would like to thank Associate Professor R. C. Carolin for advice during my work on *Pimelea* and Mr. L. Pedley of the Queensland Herbarium for allowing me to use his notes on this species.

REFERENCE

Everist, S. L. (1974). 'Poisonous Plants of Australia.' (Angus & Robertson: Sydney.)

Manuscript received 5.9.1979

TWO NEW SPECIES OF *DAMPIERA* (GOODENIACEAE) FROM CENTRAL AUSTRALIA

M. T. M. Rajput

ABSTRACT

Rajput, M. T. M. (John Ray Herbarium, University of Sydney, Australia, 2006) 1980. Two new species of Dampiera *(Goodeniaceae) from inland Australia. Telopea 2 (1): 57–58.*—Two new species, *Dampiera roycei* and *D. dentata* are described so that they may be used in the forthcoming Flora of Central Australia.

INTRODUCTION

A revision of *Dampiera* is being prepared in which a number of species are to be described for the first time. Descriptions of two of these are supplied here, so that their names may be used in the forthcoming publication on the Central Australian flora, which is likely to be published before the generic revision.

Dampiera roycei *M. Rajput*, sp. nov.

Holotype: 40 miles west of Sandstone towards Mt Magnet, Western Australia, *R. D. Royce 10482*, 17.10.1972 (PERTH).

Caules teretes costati tomento incano. Folia oblongo-obovata vel oblongo-elliptica tomento incano in superficiebus ambabus vel in pagina superiore glabrescentia 7–35 mm longa 3–13 mm lata marginibus integris. Sepala corollaque extus pilis longis patentibus incanis instructa.

Low perennial shrub, stems ribbed, terete, brownish-grey tomentose-pubescent. Leaves cauline, sessile, oblong-obovate or oblong-elliptic, 7–35 mm long, 3–13 mm wide, lower ones spathulate, tomentose on both surfaces, although less so or even glabrescent on the upper one; margin entire but papillate. Flowers arranged in cymes with bracts which are usually leaf-like but often much smaller; peduncle pubescent with dendritic-plumose hairs. Sepal lobes c. 1 mm long, covered with long spreading hairs. Corolla blue, 10–12 mm long, pubescent outside with dark grey spreading hairs; the wings slightly veined; auricle yellow-brown; calli 4–5 in each row or sometimes obsolete. Ovary unilocular with dark grey dendritic and a few plumose hairs. Ovule solitary, oblong. Indusium 2-lipped.

This species is close to *D. linearis* but can be distinguished from that species by its brownish-grey tomentum on the stem and by the oblong-obovate or oblong-elliptic entire leaves, which are greyish tomentose on both surfaces or glabrescent on the upper surface. According to Krause (1912) it would be placed in sect. *Eu-Dampiera* (*Dampiera*) and I consider this to be correct. It is found in scattered locations in the drier parts of Western Australia.

The specific epithet refers to the collector of the Holotype, Robert D. Royce, formerly Curator of the Western Australian Herbarium.

Dampiera dentata *M. Rajput*, sp. nov.

Holotype: Dean Range, Western Australia, *P. K. Latz 4174*, 26.8.1973 (PERTH). Isotypes: CANB, K, MEL, NSW, NT.

Folia oblonga lanceolata vel interdum spathulata utrinque glabra marginibus dentatis. Flores numerosi in capitis terminantibus scapas fere glabras bracteis lanceolatis acutis ± concavis immixti. Corolla pilis albidis plumosis extus instructa, callis obsoletis.

Perennial herb to 40 cm high with a basal cluster of leaves. Leaves sessile or petiolate, oblong-lanceolate or spathulate, glabrous on both surfaces, deeply dentate, 5–16 cm long, 3–15 mm wide. Flowers subtended by reduced braets, loosely arranged and numerous in heads which elongate into spikes up to 40 cm long in the fruiting stage. Corolla blue, outside hairy with plumose white hairs, 3.5–5 mm long; the wings slightly veined; auricle yellow; calli obsolete. Ovary unilocular, with white plumose hairs. Ovule solitary, oblong. Indusium 2-lipped. Fruit oblong-elliptic 2–3 mm long surmounted by the persistent sepals, style and stamens.

This species would be placed in sect. *Cephalantha* Benth. according to Krause (1912) and I consider this to be correct. It differs from others of the section in the oblong-lanceolate, deeply dentate leaves, the glabrous scape and the hairs on the outside of the corolla becoming shorter towards the apex. It is fairly common in the arid areas on the border of Western Australia and Northern Territory. The specific epithet refers to the deeply dentate leaves.

ACKNOWLEDGEMENTS

I would like to thank Associate Professor Carolin for advice during my work on *Dampiera* and Dr L. A. S. Johnson for comments on this contribution.

REFERENCE

Krause, K. (1912). *Goodeniaceae* und *Brunoniaceae*. 'Das Pflanzenreich.' Heft 54. (Engelmann: Leipzig).

Manuscript received 5.9.1979

THREE NEW SPECIES OF *CALANDRINIA* (PORTULACACEAE) FROM INLAND AUSTRALIA

Syeda Saleha Tahir*

(Accepted for publication 4.12.1979)

ABSTRACT

Syeda, Saleha Tahir (John Ray Herbarium, University of Sydney, Australia, 2006) 1980. Three new species of Calandrinia *(Portulacaceae) from inland Australia. Telopea 2 (1): 59–61.—Calandrinia reticulata, C. papillata* and *C. porifera* are described as new species.

INTRODUCTION

I have examined all herbarium specimens of *Calandrinia* located in the State Herbaria of Australia during a review of the genus in Australia. In addition I have examined type specimens or photographs of types of all species described to date except those which were destroyed in Vienna and Berlin during the last war. It has become clear that at least three undescribed species occur within the boundaries of the proposed Central Australian Flora. These are described here.

Calandrinia porifera *Syeda*, **sp. nov.**

Herba carnosa scapis numerosis 3–9 cm longis. Petala 5, obovata usque anguste elliptica 0.8–2.0 cm longa. Stigmata 4 usque ad bases libera. Capsula obpyriformis poro terminali dehiscens.

Holotype: Cundelee Mission east of Kalgoorlie and north of T.A. railway, *P. Boswell C36*, Spring 1967 (PERTH).

The specific epithet refers to the poricidal dehiscence of the capsule.

Succulent herb with numerous scapes 3–9 cm long arising from the basal tuft of leaves. Leaves many at the base in a tuft as well as on the upper part of the scapes, obovate to orbicular, 1.0–3.5 mm long, 1.0–1.3 mm wide, subsessile, opposite or alternate. Flowers in monochasia; pedicel spreading, 3–5 mm long; bracts opposite, scarious, acuminate, 0.5–1.1 mm long, 0.4–0.5 mm wide. Sepals orbicular to broad-ovate, obtuse, 1.5–2.0 mm long, 2.0–2.5 mm wide, thin. Petals 5, obovate to narrow-elliptic, 0.8–2.0 mm long, 0.4–1.0 mm wide. Stamens 5–7; filaments united at the base to form a ring around the base of the ovary, adnate to the petals at the base, 0.5–1.0 mm long; anthers ovate-oblong, versatile, 0.2–0.4 mm long, 0.1–0.2 mm wide. Ovary globular, translucent, 0.5–0.9 mm diam.; stigmata 4, free to the base, 0.2–0.4 mm long; ovules c. 10, attached to the unbranched placenta. Capsule obpyriform, as long as the sepals or a little longer, opening by a pore at the top. Seeds c. 10, ovoid, red-brown, colliculate, glossy, c. 0.3 mm long, 0.2 mm wide.

This species differs from all others in Australia except *C. disperma* J. M. Black, and *C. papillata* Syeda, in that the capsule opens through a terminal pore. The capsule of *C. disperma*, however, is very swollen at the base, where a single seed is contained. In the narrow-attenuate upper part another slightly longer and narrower seed is held. Moreover, the rim of the pore is surmounted by minute teeth in *C. disperma*. A comparison with *C. papillata* is made under that species in this contribution.

The species is known only from the type locality.

* Present address: Botany Department, University of Sind, Jamshore, Pakistan.

Calandrinia reticulata *Syeda*, **sp. nov.**

Herba carnosa. Caules basilares ramosi unusquisque fasciculum foliorum et scapas plures 8–24 cm longas ferens. Petala 5 obovata usque ad elliptica 7–8 mm longa. Stamina numerosa. Stigmata 3 libera usque ad bases. Capsula ovoidea 3 valvis dehiscens. Semina reticulata c. 0.2 mm diam.

HOLOTYPE: Simpsons Gap National Park, Northern Territory, *P. K. Latz 4895*, 18.4.1974 (NT 43058).

The specific epithet refers to the characteristic pattern on the surface of the seed.

Succulent herb with basal stems erect, up to 3 cm high and branching, with each branch bearing a fascicle of leaves. Scapes 1–3 or more on each stem, axillary, 8–24 cm long, leafless and bearing a few flowers near the top. Leaves linear to linear-lanceolate or oblanceolate, 2–6 cm long, 1.5–5.5 mm wide, sessile. Flowers few in monochasia on a ± erect peduncle; pedicels 0.5–2 cm long; bracts opposite, scarious, acute, 1–1.5 mm long. Sepals very broad-ovate, 4–5 mm long, 5–6 mm wide, herbaceous. Petals 5, obovate to elliptic or spathulate, 7–10 mm long, 3–5.5 mm wide, pink-purple. Stamens numerous (> 10) in two or three groups; filaments of unequal length, connate at the base and adnate to the base of the petals; anthers oblong-ovate, versatile, 0.4–0.7 mm long, 0.3–0.4 mm wide. Ovary subglobular, whitish-brown, translucent, 2–2.5 mm diam.; stigmata 3, free to the base, linear, red-brown, 1.4 mm long. Ovules numerous (> 10), reniform, 0.1–0.4 mm long attached to a branched placenta. Capsule, ovoid with an erect pedicel, light brown and with a smooth shining surface, a little longer than the sepals, 3-valved to the base. Seeds numerous, red-brown, glossy, reticulate, 0.2 mm diam.

This species differs from all others in Australia in possessing reticulate seeds. It is probably closest to *C. remota* J. M. Black, which has a glossy, almost smooth seed.

SPECIMENS EXAMINED: NORTHERN TERRITORY: Woodlands Station Shearing Shed, *T. L. Setter 325*, 9.9.1973 (PERTH); 29 miles [46 km] S. of Alice Springs, *G. Chippendale*, 11.11.1954 (BRI 004895); 4 miles [6.5 km] N. of Mt Swan Station, *R. A. Perry 3331*, 12.3.1953 (NT 20021); 13 miles [21 km] S. of Angas Downs Homestead, *G. Chippendale*, 24.11.1954 (NT 624). WESTERN AUSTRALIA: Lawlers, *F. H. Hann* 8.1902 (BRI 88069).

Calandrinia papillata *Syeda*, **sp. nov.**

Herba carnosa scapis pluribus 10–35 cm longis in axillis foliorum basilarium dispositis. Folia linearia usque ad oblanceolata 8–55 mm longa. Flores in monochasiis bracteatis dispositi. Petala 7–9, anguste oblanceolata usque ad obovata 9–18 mm long. Stamina numerosa. Stigmata 4 usque ad bases libera. Capsula poro terminali valvis brevissimis dehiscens. Semina papillata c. 0.25 mm diametro.

HOLOTYPE: Davis Creek, Lycus River, Western Australia, *C. A. Gardner 6105*, 25.9.1941 (PERTH).

Succulent herb with scapes several and up to 35 cm long, arising from the axils of the basal leaves. Leaves cauline and basal, alternate or 2–4 at each node, sessile or nearly so, linear to oblanceolate, 8–55 mm long, 2–6 mm wide. Flowers arranged in monochasia; pedicels spreading, 5–22 mm long; bracts opposite, scarious or sometimes leafy, 2.5–4 mm long. Sepals ovate, thin, 5–6 mm long, 3.5–5.5 mm wide. Petals 7–9, narrow-oblanceolate to obovate, 9–18 mm long, 2–5.5 mm wide, pink. Stamens numerous (> 10); filaments of unequal length, connate into a membranous cup around the base of the ovary, c. 6 mm long; anthers oblong, 0.5–0.8 mm long, 0.3–0.4 mm wide. Ovary ovoid, 2.5–3.5 mm long; stigmata 4, free to the base, linear, 2.5–7 mm long; ovules numerous (> 10), attached to a branched placenta. Capsule, conical, brown to dark brown, dehiscing through a pore at the top and occasionally split into 4 valves at the summit, as long as or slightly longer than the sepals. Seeds numerous (> 10), red-brown, matt, reniform, c. 0.25 mm long, papillate.

This species is close to *C. porifera* Syeda from which it differs in sometimes having 4 very short valves to the capsule, larger petals, and most clearly in the papillate seeds.

Specimens Examined: Western Australia: 24 km S. of Woodlands Station on Woodlands–Mt Clere Road, *T. L. Setter 401*, 7.10.1973 (PERTH); Belele Station WNW. of Meekatharra, *D. W. Goodall 3286*, 6.11.1965 (PERTH): 21 km from Mt Magnet on Geraldton Road. *Y. Chadwick 1988*, 16.10.1963 (PERTH).

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NEW SPECIES AND NEW COMBINATIONS IN GOODENIACEAE AND CAMPANULACEAE

R. C. Carolin

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ABSTRACT

Carolin, R. C. (John Ray Herbarium, University of Sydney, Australia 2006) 1980. New species and new combinations in Goodeniaceae and Campanulaceae. Telopea 2 (1): 63–75.—The following new species are described: *Isotoma lutieola* (Campanulaceae); *Goodenia eentralis*, *G. rupestris*, *G. wiluuensis*, *G. peacoekiana*, *G. selwerineusis*, *G. suffruteseens*, *G. augustifolia*, *G. gibbosa*, *G. megasepala*, *G. iyouta*, *G. oeeidentalis*, *G. faueium*, *G. virgata*, *G. triodiophila*, *G. stellata*, *Seaevola basedowii*, and *Cooperuookia seabridiuseula* (Goodeniaceae). The new name *Goodenia krauseana* is supplied for *Goodenia nana* Krause non De Vriese, and the new combination *Verreauxia verreauxii* (De Vriese) Carolin is made for *V. panieulata* Benth.

INTRODUCTION

A number of species of *Goodenia* are here described for the first time and a new combination provided in that genus. These, together with other undescribed species and necessary new combinations, have become evident during a revision of the genus as a whole which will be published in the future. The names supplied here, unlike the remaining undescribed taxa etc., are required for the forthcoming Flora of Central Australia which is likely to be published before the generic revision. The species are referred to by their position in Krause's system (Krause, 1912), although this needs some revision.

One new species of *Isotoma* and one of *Scaevola* from the central Australian area are described for the first time. The opportunity is also taken here to describe a new species of *Cooperuookia* and to make a new combination in *Verreauxia*.

Isotoma luticola *Carolin*, sp. nov.

Holotype: 3 km n. Wauchope, 20° 37′ S., 134° 14′ E., *P.K. Latz 5152*, 11.6.1974 (NT 43754).

Herba prostrata pilis paucis instructa caulibus ad 25 cm longis. Folia sessilia oblonga ad elliptica usque ad 1.5 cm longa dentibus crassis instructa. Flores in pedunculis ad 3 cm longis ex axillis foliorum distalium natis. Corolla lilacina ad caerulea vel violacea tubis circiter 5 mm longis. Tubus antherarum setis pluribus in orificio sed duabus earundum reliquibus ad 2-plo longioribus. Capsula globularis ad obconica 4–6 mm longa.

Prostrate herb with a few scattered hairs on the stems and leaves. *Stems* up to 25 cm long. *Leaves* sessile, oblong to elliptic, up to 15 mm long and 10 mm wide, coarsely toothed. *Flowers* borne on almost glabrous peduncles up to 3 cm long in the axils of the upper leaves. *Sepals* 1.5–2 mm long. *Corolla* lilac to blue or violet but becoming paler towards the base: tube c. 5 mm long: lobes spreading, 2–3 mm long. *Anther tube* c. 1.5 mm long with a number of bristles at the orifice, of which 2 of the lower ones are 1 mm long and thus much longer than the others. *Capsule* globular to obconic, 4–6 mm long, dehiscing through two valves. *Seeds* numerous.

This species occurs in muddy situations or damp earth on the margins of creeks and water pools in the Northern Territory.

The specific epithet refers to its normal habitat on mud or damp earth.

Specimens Examined: Northern Territory: Long Hole, 30 m [48 km] NW. Willowra HS., *G. Chippendale*, 30.7.1958 (NT 4741); Hanson River, *R. Rawlins*, 21.4.1962 (NT 8832); Stirling Stn., 21° 47′ S, 133° 43′ E, *A. S. Mitchell 043*, 3.7.1974 (NT 42084); Marqua Stn., 22° 39′ S, 137° 10′ E, *P. K. Latz 2625*, 25.5.1972 (NT 35142); Curlew W. H., Lander River, *G. Chippendale*. 31.7.1958 (NT 4801).

Goodenia krauseana *Carolin*, **nom. nov.**

REPLACED SYNONYM: *Goodenia nana* Krause, Pflanzenr. 54: 80 (1912) *nom. illeg. non* De Vriese, Nat. Verh. Holl. Maats, Wet. Haarlem, 10: 132 (1854), which is a taxonomic synonym of *Goodenia humilis* R. Br. The species is named in honour of K. Krause who revised the family in 1912 for Das Pflanzenreich.

Goodenia rupestris *Carolin*, **sp. nov.**

HOLOTYPE: un-named pass between Hull and Docker Rivers, Petermann Ranges, Northern Territory, *R. Carolin 5333*, 21.8.1966 (NSW). ISOTYPE: SYD.

Herba gossypine tomentosa ascendens vel pendula caulibus latis condensatis. Folia elliptica vel anguste elliptica vel anguste obovata usque ad 6 cm longa integra basin versus sensim in petiolum indistinctum contracta. Flores in racemis foliosis dispositi: bracteolae lineares, 4–5 mm longae: pedicellus non articulatus. Corolla flava sacco obsoleto atque scriebus cnationum obscurarum munita: lobi superiores alis 1.5 mm latis auriculatis. Ovulae 16–20. Indusium depresse obovatum, 1 mm longum setis super labiis affixis. Capsula elliptica 6 mm longa valvis duabus profunde bifidis erectis dehiscens. Semina ignota.

Ascending or pendulous perennial herb with a thick well-developed stock and scapes to 20 cm long. *Leaves* elliptic to narrow-obovate, 2–6 cm long, narrowing very gradually towards the base, entire, acute, cottony-tomentose on both surfaces but less so on the upper one and often glabrescent; leaves on the scape smaller and often sessile. *Flowers* arranged in terminal leafy racemes with bracteolate pedicels up to 1.2 cm long. *Sepals* linear-deltoid, 4–5 mm long, adnate to the ovary almost to its summit. *Corolla* yellow, 14–16 mm long, cottony-tomentose outside, villous inside with some small cnations, anterior pouch almost obsolete; superior lobes auriculate. *Style* 5–6 mm long; indusium depressed-obovate or semi-orbicular, c. 2 mm wide slightly villous and with white bristles on the lips. *Capsule* ellipsoid, c. 6 mm long, 2-valved to the base each valve itself split half-way. *Seeds* not seen.

This species would be placed in ser. *Rosulatae* according to the classification of Krause (1912). The specific epithet refers to occurrence of this species on the cliffs of the Petermann Ranges in the Northern Territory which is its only recorded locality to date. It is a fairly distinct species, possibly related to *G. xanthosperma* F. Muell. from which it can be distinguished by its entire leaves, perennial habit and the fact that the bristles around the orifice of the indusium are affixed on the lip rather than a short distance behind the lip.

Goodenia peacockiana *Carolin*, **sp. nov.**

HOLOTYPE: 23 miles from Yelma on the Leonora road, Western Australia, *R. Carolin 5911*, 27.7.1967 (NSW). ISOTYPE: SYD.

Herba prostrata vel decumbens probabiliter annua. Caules condensati rosula persistenti foliorum: scapi usque ad 25 cm longi pilis arachnoideo-multicellularis paucis. Folia elliptica usque ad anguste obovata 2–6 cm longa, usque ad 1.2 cm lata versus basin sensim in petiolum indistinctum contracta dentata plus minusve lobata glabra vel pilis multicellularis paucis instructa. Flores bracteolis linearibus pedicellisque non articulatis in racemis foliosis dispositi. Corolla flava saepe nota porphyrea instructa circa 15 mm longa saeco 1/4 longitudinem ovarii aequanti atque seriebus cnationum munita. Lobi corollae superiores alis 2.5 mm latis instructi et auriculati. Dissepimentum ovarii duas partes longitudinis loculi aequans. Indusium late obovatum plicatum setis super labis affixis. Fructum obovoideum vel ellipsoideum duabus valvis dehiscens. Semina elliptica manifeste papillata ora crassa sed ala angustissima.

Prostrate to decumbent probably annual herb with a thin taproot. Scapes up to 25 cm long sprinkled with arachnoid multicellular hairs. *Leaves* elliptic to narrow-obovate, 2–6 cm long, dentate to ± lobed, glabrous or with a few scattered hairs when young; leaves on the scape smaller, often sessile and with a pronounced basal lobe on one side only. *Flowers* arranged in terminal leafy racemes with glabrous peduncles 5–10 cm long, bracteolate. *Sepals* lanceolate, 6 mm long. *Corolla* yellow, often with brownish-purple markings, c. 15 mm long, pubescent towards the base outside but ± glabrous towards the top outside, pubescent and with rows of enations inside and with an obscure pouch; superior lobes auriculate. *Ovary* cottony-tomentose with a dissepiment two-thirds as long as the loculus and bearing c. 36 ovules; style 3 mm long; indusium broad-ovate, 2 mm wide, villous and with white bristles on the lips. *Capsule* obovoid to cylindrical, c. 10 mm long, dehiscing through 2 gaping valves. *Seeds* flattened, elliptic, 1.3 mm long, dark brown, prominently aculeate to setose and with a prominent rim but a very narrow wing.

This species would be placed in ser. *Rosulatae* Krause. It has been confused with *Goodenia xanthosperma* F. Muell. but differs in having a basal lobe on the cauline leaves and in the lack of a dense tomentum on the undersurface of the leaves. It is found only in Western Australia. The specific epithet refers to my friend Dr. W. J. Peacock, who has accompanied me on collecting expeditions and has contributed to our knowledge of the cytology of the Goodeniaceae.

Goodenia wilunensis *Carolin*, **sp. nov.**

HOLOTYPE: 25 miles (40 km) W. of Wiluna, Western Australia, *C. A. Gardner 2382*, 23.7.1931. (PERTH). ISOTYPE: BM.

Herba ascendens vel decumbens vel prostrata villosa annua. Scapi usque ad 30 cm longi. Folia rosulata elliptica vel obovata 4–6 cm longa 8–15 mm lata, gossypine villosa pilis simplicibus multicellularibusque, dentata acuta basim versus sensim in petiolum indistinctum decrescentia. Flores in racemis foliosis dispositi: pedicelli 3–6 cm longi; bracteolae anguste ovatae 4 mm longae. Sepala anguste ovata 6 mm longa acuta in dimidio inferiore ovarii affixa. Corolla flava circa 18 mm longa villosa extus atque in fauce intus pubescens: lobi superiores late alati auriculati prominentes. Dissepimentum ovarii dimidium longitudinem loculi aequans. Indusium transverse semiellipticum 1 mm longum 3–5 mm latum in plica dense villosum orificio recto. Capsula globularis vel subglobularis 7 mm longa 5 mm lata. Semina plana straminea ora alata atque indistinctissima.

Ascending to decumbent or prostrate herb. *Scapes* up to 30 cm long, terete, villous. *Leaves* mostly basal, elliptic to obovate, 4–6 mm long, narrowing gradually towards the base, dentate, acute, villous; leaves on the scape somewhat smaller. *Flowers* in leafy racemes on pedicels 3–6 cm long with two narrow bracteoles c. 4 mm long. *Sepals* narrow-ovate, 6 mm long, villous, adnate to the ovary for about half its length. *Corolla* yellow with violet markings, c. 18 mm long, villous outside, pubescent inside in the throat with an obscure pouch; superior lobes auriculate. *Ovary* with a dissepiment about half the length of the loculus; indusium transverse-semi-elliptic, 3.5 mm wide, villous and with white bristles on the lips. *Capsule* subglobular, 7 mm long, dehiscing through two entire valves. *Seeds* flattened, yellowish-brown with a distinct rim but an indistinct narrow wing.

This species would be placed in ser. *Rosulatae* according to Krause's (1912) classification. It is a distinctive species and can be distinguished from all other members of that section by the villous hairs and the narrow-ovate sepals which are affixed to the lower half of the ovary. The specific epithet refers to the locality of the type collection.

Goodenia centralis *Carolin*, sp. nov.

HOLOTYPE: 1.5 miles (2.5 km) E. Irving Creek, Petermann Range, Northern Territory, *G. Chippendale*, 24.6.1958 (NT 4643). ISOTYPE: NSW 98788.

Herba prostrata radice tenui sparsim araneoso-pubescens pilis multicellularibus saepe glabrescens. Scapi usque 80 cm longi. Folia obovata vel spathulata, 3–10 cm longa, 1.5–3 cm lata grosse dentata basim versus sensim in petiolum indistinctum contracta. Flores in racemis foliosis dispositi: bracteolae lineares: pedicellus non articulatus. Corolla flava sacco quam ovario 1/3 plo longiore atque seriebus enationum munita: lobi superiores alis 1.5 mm latis auriculatis instructi. Ovulae 28–30. Indusium depresse obovatum, 1 mm longum setis post labium affixis. Capsula elliptica vel ovoidea circa 8 mm longa duabus valvis bifidis erectis dehiscens. Semina plana oblonga.

Prostrate annual herb with scapes up to 80 cm long. *Leaves* obovate to spathulate, 3–10 cm long, arachnoid-pubescent but often sparsely so and often glabrescent, coarsely dentate, obtuse or terminated by a tooth. *Flowers* arranged in long leafy racemes on bracteolate pedicels up to 6 cm long. *Sepals* linear-deltoid, c. 2 mm long, adnate to the ovary almost to its summit. *Corolla* yellow sometimes with purplish markings, 12–15 mm long, sparsely arachnoid-pubescent outside and pubescent with rows of enations inside; anterior pouch indistinct, superior lobes auriculate. *Ovary* arachnoid-pubescent with a dissepiment about two-thirds as long as the loculus and bearing 28–30 ovules; style c. 6 mm long, villous; indusium depressed-ovate, 2 mm wide, villous and with white bristles on the lips. *Capsule* ovoid to ellipsoid, c. 8 mm long, dehiscing through two valves which themselves sometimes divide to their middle. *Seeds* flattened, yellow-brown, oblong, 2.5 mm long, minutely aculeate with a distinct rim but a narrow wing.

This species has been previously confused with *Goodenia rotundifolia* R. Br. but it differs from the latter in having arachnoid rather than stiff simple hairs on the leaves and stems. It would be placed in ser. *Rosulatae* Krause. The specific epithet refers to the distribution of the species in central Australia where it occurs in a variety of soil types in Western Australia and the Northern Territory.

Goodenia schwerinensis *Carolin*, sp. nov.

HOLOTYPE: 4 miles (6.5 km) N. of east end of Schwerin Mural Crescent, Western Australia, *D. E. Symon 2431*, 2.8.1962 (PERTH). ISOTYPE: ADW.

Herba decumbens vel ascendens confertim pubescens pilis simplicibus et multicellularibus. Caules condensati. Scapi usque 40 cm longi in axillis foliorum rosulatorum inserti. Folia rosulata anguste elliptica vel anguste oblonga vel anguste obovata 5–12 cm longa 1–2 cm lata dentata vel lyrata basim versus in petiolum contracta. Folia scaporum basi lobo solitario instructa. Flores in racemis foliosis dispositi pedicellis non articulatis bracteolisque linearibus. Corolla flava sacco fere obsoleto et seriebus enatiorum munita. Lobi superiores corollae auriculati alis circa 1 mm latis. Indusium depresse obovatum plicatum setis super labiis affixis. Fructus ovoideus circa 10 mm longus duabus valvis integris erectis crassiusculis dehiscens. Semina plana setosa elliptica ora crassa sed ala fere obsoleta.

Prostrate to decumbent or ascending herb with scapes up to 40 cm long. *Basal leaves* narrow-elliptic to narrow-obovate, 5–12 cm long, pubescent, dentate to lyrate, narrowing very gradually towards the base; leaves on the scapes narrower and almost sessile with a lobe on one side at the base. *Flowers* arranged in a leafy raceme on pedicels up to 3.5 cm long; bractcoles linear, 4–5 mm long. *Sepals* linear-deltoid, 6–7 mm long. *Corolla* yellow, 12–15 mm long, pubescent outside with mostly simple hairs, pubescent inside and with rows of many prominent enations; anterior pouch almost obsolete; superior lobes auriculate. *Ovary* pubescent with a dissepiment up to three-quarters the length of the loculus and bearing 28–30 ovules;

style glabrous, 5 mm long; indusium depressed-ovate, 2.5 mm wide, villous and with white bristles on the lips. *Capsule* c. 10 mm long, dehiscing through two entire thick erect valves. *Seeds* flattened, elliptic, brown, 3 mm long, aculeate with a thickened rim but an indistinct wing.

This species would be placed in ser. *Rosulatae* Krause close to *Goodenia glabra* R. Br. from which it differs in its densely pubescent leaves. It occurs in Western Australia and the southwest of the Northern Territory. The specific epithet is taken from the Schwerin Mural Crescent near which it occurs.

Goodenia suffrutescens *Carolin*, **sp. nov.**

HOLOTYPE: 30 miles (48 km) S. of Halls Creek, Billiluna Station, Western Australia, *R. Carolin 7915*, 22.8.1970 (NSW). ISOTYPES: SYD, PERTH.

Suffrutex usque 1 m altus. Folia oblanceolata ad obovata 8–11 cm longa pubescentia ± viscidia pilis glandulosis dentataque. Flores in racemis foliosis terminalibus dispositi. Pedunculi usque ad 2 cm longi bracteolis ovato-elliptica (2–) 6–15 mm longis sessilis. Pedicelli usque ad 5 cm longi indistincte articulati. Sepala lanceolata 3 mm longa. Corolla coerulea 15–20 mm longa pubescens, pilis glandulosis confertis atque paucis simplicibus extus etiam pilis paucis longis rigidis intus margines loborum inferiorum versus. Saccus corollae et enationes prominentes. Ovarium glandulose pubescens dissepimento tres partes longitudinis loculi aequanti. Indusium oblongum 2 mm longum villosum setis albido-purpurascentibus super labiis. Capsula ovoidea usque cylindrica 1 cm longa duabus valvis integris dehiscens.

Sub-shrub up to 1 m tall, the stems sometimes decumbent. *Leaves* usually ± clustered at the base of the scapes, oblanceolate to obovate, 8–11 cm long, glandular-pubescent and viscid, irregularly dentate and tapering very gradually towards the base. *Flowers* arranged in terminal leafy thyrses; peduncles up to 2 cm long; bracteoles obovate to elliptic, 6–14 mm long; pedicels up to 5 mm long. *Sepals* lanceolate, c. 3 mm long. *Corolla* blue, 15–20 mm long, densely glandular-pubescent outside with a few simple hairs and with some long stiff white hairs and very prominent enations inside; superior lobes enclosing the indusium but only indistinctly auriculate; anterior pouch prominent and as long as the ovary. *Ovary* glandular-pubescent with a dissepiment three-quarters as long as the loculus and bearing up to 40 ovules; style 8–9 mm long, villous; indusium oblong, 2 mm wide, villous and with white to purplish bristles on the lips. *Capsule* ovoid to cylindrical, c. 1 cm long, dehiscing through two entire valves.

According to Krause (1912), this species would be placed in ser. *Caerulea* Benth. close to *G. scaevolina* F. Muell. It differs from that species in having broader bracteoles, coarser glandular hairs and the superior lobes of the corolla enclosing the indusium. It is only known from the Tanami desert on the borders of Western Australia and Northern Territory. The specific epithet refers to the sub-shrubby habit of the plant.

Goodenia angustifolia *Carolin*, **sp. nov.**

HOLOTYPE: Nockatunga, Queensland, *R. Carolin 4159*, 8.1964 (NSW).

Herba erecta vel ascendens usque ad 25 cm alta, glauca. Folia basalia linearia terctia canaliculata integra sessilia 5–8 cm longa. Folia caulina subfasciculata quam folia basalis aliquantum breviora. Flores in racemis brevibus vel umbellis dispositi pedunculus 5–10 mm longis bracteolisque lineari-deltoidcis 1–1.5 mm longis. Sepala oblongo-lanceolata 2.5–3 mm longa. Corolla flava 10–12 mm longa glabra extus simpliciter pubescens ac intus glandulose. Lobi superiores corollae auriculi unde ala inferiore sino longo disjuncti. Dissepimentum ovarii tertiam longitudinem loculi aequans. Indusium transverse oblongum 1.5 mm longum convexum setis albis usque 0.3 mm longis super labiis munitum. Capsula et semina ignotae.

Erect or ascending herb up to 25 cm high. *Leaves* basal and cauline the latter tending to be fasciculate, linear, terete and channelled, thick, glabrous, ± glaucous, 5–8 cm long; cauline leaves somewhat shorter. *Flowers* arranged in short terminal racemes or umbellate on glabrous pedicels 5–10 mm long; bracteoles linear-deltoid, c. 1 mm long. *Sepals* oblong-lanceolate, entire, acute, glabrous, c. 3 mm long. *Corolla* bright yellow, 10–12 mm long, glabrous outside with an indistinct pouch; superior lobes auriculate with the auricle separated from the wing by a deep long sinus. *Ovary* glabrous, glaucous with a dissepiment c. one-third as long as the loculus and bearing c. 24 ovules; style 3 mm long, glabrous; indusium transverse-oblong, 2 mm wide, convex with a tuft of villous hairs on either side and white bristles around the orifice.

According to Krause's system this species would be placed in ser. *Pedicellosae* Benth. close to *Goodenia glauca* F. Muell. It can be distinguished from *G. glauca* in having linear-terete leaves. It is known only from the type collection. The specific epithet refers to the narrow leaves.

Goodenia gibbosa *Carolin*, **sp. nov.**

HOLOTYPE: South end of Dean Range, Western Australia, *R. C. Carolin 6071*, 5.8.1967 (NSW).

Herba prostrata vel decumbens saepe stolonifera. Folia elliptica usque ad oblanceolata (2–) 5–8 cm longa ± simpliciter molliterque pubescentia, dentata vel integra basim versus sensim contracta, in rosulis in caulorrhiza vel in stolonibus disposita. Flores in racemis vel umbellis foliosis vel in axillis foliorum basalium dispositi pedunculis glabris vel plus minusve molliter pubescentibus articulatis post casum capsularum persistentibus. Sepala lanceolata vel ovata 2–3 mm longa. Corolla flava 12–17 mm longa glabra vel extus sparsissime pubescens vel intus pubescens, saeco prominentissimo ovarium aequanti. Lobi superiores corollae auriculati. Ovarium dissepimento longitudine vix dimidiam longitudinem loculi aequanti. Indusium transverse oblongum 1.5 mm longum barbellatum infra atque setis albidis 0.5 mm longis super labro superiore munitum. Capsula globularis vel subglobularis 5–6 mm diametro duabus valvis dehiscens. Semina orbicularia 3 mm diametro reticulata ala sordida circa 5 mm lata.

Prostrate to decumbent herb with basal group of leaves and further tufts on the ends of short stolons. *Leaves* elliptic to obovate or oblanceolate, 5–8 cm long, sprinkled with soft appressed or spreading simple hairs, dentate to almost entire, tapering very gradually towards the base; cauline leaves smaller than the basal ones. *Flowers* arranged in leafy racemes or in umbels or solitary in the axils of the leaves. *Sepals* lanceolate to ovate, 2–3 mm long, adnate to the ovary for c. two-thirds of its length. *Corolla* yellow, 12–17 mm long, glabrous outside or with a few scattered hairs; anterior pouch prominent and as long as or slightly longer than the ovary; superior lobes auriculate. *Ovary* glabrous with a dissepiment c. half as long as the loculus and bearing c. 20 ovules; style 5 mm long; indusium transverse-oblong, 2.5 mm wide, villous and with white bristles around the lips. *Capsule* globular or nearly so, 5–6 mm diam., dehiscing through two entire valves. *Seeds* flattened, orbicular, c. 3 mm diam., black, reticulate-foveate, with a distinct rim and a greyish wing.

This species would be placed in ser. *Pedicellosae* Benth. according to the system of Krause (1912), and has affinities with *G. pinnatifida* Schlechtd., from which it can be distinguished by a much more marked stoloniferous habit, a much more pronounced corolla pouch and the pedicels persistent long after the valves of the capsule have fallen. It occurs in Western Australia and the Northern Territory and is common in the central Australian area. The specific epithet refers to the gibbous appearance of the inferior ovary due to the presence of the corolla pouch.

Goodenia megasepala *Carolin*, **sp. nov.**

HOLOTYPE: Beale Range, Queensland, *K. A. Williams 78202*, 8.1978 (BRI 264700).

Herba prostrata vel decumbens substolonifera. Folia oblanceolata vel anguste elliptica 2–10 cm longa hirsuta dentata vel pinnatisecta basim versus sensim in petiolum indistinctissimum contracta in rosula basali vel in caespite caulini disposita. Flores in pseudoumbellis foliosis terminalibus dispositi pedunculis 4–6 cm longis ebracteolatis indistincte articulatis. Sepala anguste elliptica vel lanceolata 6–8 mm longa. Corolla flava c. 18 mm longa hirsuta extus et basi pubescens intus. Ovarium hirsutum dissepimento circa dimidiam longitudinem loculi aequante. Indusium transverse oblongum 1.5 mm longum setis albidis super labiis munitum. Capsula globularis c. 6 mm diametro duabus valvis integris tarde secedentibus. Semina plana reticulata alis angustis.

Prostrate to decumbent herb with a stout tap-root. *Scapes* pubescent, up to 25 cm long. *Leaves* mostly basal, oblanceolate to narrow-elliptic in outline, 2–10 cm long, pubescent, dentate or pinnately lobed, tapering very gradually towards the base. *Flowers* arranged in leafy umbel-like racemes on pedicels up to 6 cm long, ebracteolate. *Sepals* narrow-elliptic to lanceolate, 6–8 mm long, 1.5 mm wide. *Corolla* yellow, c. 18 mm long, pubescent-hirsute outside, pubescent inside especially towards the base; anterior pouch obscure; superior lobes auriculate. *Ovary* pubescent with a dissepiment c. half as long as the loculus and bearing c. 30 ovules; style c. 6 mm long; indusium transverse-oblong, 3.5 mm wide, convex, with a few scattered villous hairs and some white bristles on the lips. *Capsule* globular, c. 6 mm diam., hirsute, dehiscing through two entire valves. *Seeds* flattened with a broad wing and prominent rim.

This species would be placed in ser. *Pedicellosae* Krause, although its affinities within that series are obscure. It is possibly related to *G. fasciculatis* F. Muell. & Tate, from which it can be distinguished by the larger broader sepals from which the specific epithet is derived, and the hairs on the leaves and stems which are not strigose. It is known only from the region close to Windorah in Queensland.

Goodenia iyouta *Carolin*, **sp. nov.**

HOLOTYPE: near Notabilis Hill, Gunbarrel Highway, Western Australia, *E. Bettenay 25*, 7.1965 (PERTH).

Herba prostrata. Caules usque 120 cm longi hirsuto-pubescentes. Folia basalia ignota. Bracteae ovatae vel elliptieae dentatae plus minusve pubescentes basim versus sensim in petiolum indistinctum usque ad 1 cm longum attenuatae. Flores in racemis longis foliosis dispositi pedunculis usque ad 4 cm longis ebracteolatis et non articulatis. Sepala anguste oblonga circa 3.5 mm longa pro dimidio longitudine ovarii affixa. Corolla flava 11–14 mm longa simpliciter glanduloseque brevissime pubescens extus sacco prominenti longitudinem ovarii aequante. Lobi superiores corollae indistinctissime auriculati. Ovarium pubescens tertiam longitudinem loculi aequanti. Indusium transverse oblongum 1.5 mm longum setis albidis 0.1 mm longis super labiis. Capsula subglobularis 5–6 mm diametro pubescens duabus valvis integris ad basim dehiscens. Semina orbicularia 3.5 mm diametro reticulata fusca nigrave ala brunnea pallide circa 0.5 mm lata.

Prostrate or ascending herb with stems up to 120 cm long. *Basal leaves* ephemeral; cauline leaves ovate to elliptic, up to 2 cm long, dentate, pubescent with mostly simple hairs but a few glandular ones also present, tapering very gradually towards the base. *Flowers* arranged in terminal leafy racemes on ebracteolate pedicels up to 4 cm long. *Sepals* narrow-oblong, c. 3.5 mm long. *Corolla* yellow, 11–15 mm long, simple- and glandular-pubescent outside and simple-pubescent inside particularly in the throat; anterior pouch prominent, about as long as the ovary; superior lobes auriculate. *Ovary* pubescent with simple and minute glandular hairs and with a dissepiment c. one-third as long as the loculus and bearing c. 15 ovules;

style 4–5 mm long; indusium transverse-oblong, 3 mm wide. *Capsule* subglobular, slightly compressed, 5–6 mm diam., dehiscing through two entire valves. *Seeds* flattened, orbicular, 3.5 mm diam., dark brown to almost black, reticulate-foveate, with a distinct rim and a thick pale brown wing.

This species might be placed in ser. *Foliosae* Benth. according to Krause's system but it shows no close affinity with any other species. It is known only from the drier parts of Western Australia. The specific epithet is an aboriginal word for *Triodia* spp., with which this species is frequently found growing; the epithet is indeclinable.

Goodenia occidentalis *Carolin*, **sp. nov.**

HOLOTYPE: 140 miles (224 km) W. of the Warburton Range on the road to Laverton, Western Australia, *R. Carolin 5936*, 27.7.1967 (NSW).

Herba prostrata vel decumbens. Caules usque ad 40 cm longi glabrescentes. Folia oblanceolata 2–8 cm longa plus minusve crasse dentata usque lyrata vel interdum integra pubescentia pilis simplicibus appressis basim versus sensim contracta. Flores in racemis secundis terminalibus dispositi, bracteis linearilanceolatis vel linearibus, pedunculis arcuatis ebracteolatis articulatis. Corolla flava sed interdum brunneo-purpurascens basim versus simpliciter pubescens extus sacco indistincto. Ovarium glabrum vel sparse glandulose ac simpliciter pubescens dissepimento circa quartum longitudinem loculi aequanti. Capsula globularis usque ad 3 mm diametro per duas valvas integras dehiscens. Semina orbicularia circa 2 mm diametro nigra nitida reticulata ala hyalina 0.5 mm lata qua partem corporis imbricata.

Prostrate to decumbent herb with scapes up to 40 cm long. *Leaves* mostly basal, oblanceolate, 2–8 cm long, thick, pubescent with appressed simple hairs, dentate to lyrate or sometimes almost entire, tapering very gradually towards the base. *Flowers* arranged in terminal racemes, sometimes ± secund with linear to linear-lanceolate bracts; pedicels 6–10 mm long, ebracteolate. *Sepals* ovate or lanceolate 1–1.6 mm long, adnate to the ovary for c. two-thirds of its length. *Corolla* yellow often becoming purplish-brown towards its base, 4–6 mm long; anterior pouch not prominent; superior lobes auriculate. *Ovary* glabrous or nearly so with a dissepiment scarcely half as long as the loculus and bearing 20 ovules; style c. 1.5 mm long; indusium depressed-ovate, 1–1.2 mm wide, villous and with white bristles on the lips. *Capsule* globular 2.5–3 mm diam., dehiscing through two entire valves. *Seeds* biconvex, orbicular, c. 2 mm diam., black with an overlapping hyaline mucilaginous wing.

This species would probably be placed in ser. *Pedicellosae* Benth. according to Krause's system. It has been confused with *G. filiformis* De Vriese in the past but it lacks the distinct corolla pouch of the latter and the wing of the seed overlaps the body. The specific epithet refers to its chiefly western distribution, although it has been collected in New South Wales and South Australia.

Goodenia faucium *Carolin*, **sp. nov.**

HOLOTYPE: Gorge near Mt. Liebig, Northern Territory, *G. Chippendale 3556*, 23.7.1957 (NT). ISOTYPES: CANB, MEL.

Suffrutex viscidus caulibus erectis vel ascendentibus usque 40 cm altis. Folia obovata lanceolata vel anguste elliptica usque ad 3.5 cm longa viscida pilis minutis peltatis ad basim sensim contracta plerumque sessilia. Flores in racemis foliosis terminalibus dispositi pedunculis ebracteolatis articulatis. Sepala anguste elliptica vel lanceolata 4 mm longa. Corolla flava 14–15 mm longa viscida extus pubescens intus sacco duas partes longitudinem ovarii aequanti instructa. Lobi superiores corollae ala auriculata quam alia angustiore. Ovarium transverse oblongum 1 mm longum barbula villosa infra, et setis albidis 0.2–0.3 mm longis super labiis munitum. Capsula subglobularis 4.5 mm diametro duabus valvis integris dehiscens. Semina elliptica 3 mm longa ala angusta hyalina circa 0.2 mm lata.

Perennial viscid subshrub with erect or ascending stems to 40 cm high. *Leaves* mostly cauline, obovate to narrow-elliptic, 1.5–3.5 cm long, covered with minute peltate hairs and thus apparently glabrous but viscid, dentate, acute, sessile or tapering very gradually into a short petiole. *Flowers* arranged in terminal leafy racemes on ebracteolate peduncles up to 15 mm long. *Sepals* narrow-elliptic to lanceolate, 4 mm long. *Corolla* yellow, 14–15 mm long, covered with minute viscid peltate hairs outside and with a distinct anterior pouch; superior lobes with unequal wings and auriculate. *Ovary* viscid with a dissepiment c. half as long as the loculus bearing c. 40 ovules; style 5 mm long, glabrous; indusium transverse-oblong, c. 2.5 mm wide, with a villous beard on the lower surface and white bristles on the lips. *Fruit* subglobular, 4.5 mm diam., dehiscing through two entire valves. *Seeds* flattened, elliptic, c. 3 mm long with a prominent rim and a narrow wing.

This species would be placed in ser. *Foliosae* Benth. in Krause's system. It shows some affinities with *G. larapinta* Tate but differs in having minute peltate hairs, rather than the long glandular hairs of *G. larapinta*. The specific epithet refers to the narrow valleys near Mt Liebig in the Northern Territory where this species appears to be confined.

Goodenia virgata *Carolin*, **sp. nov.**

HOLOTYPE: 73 miles (117 km) from Yuendumu on Alice Springs Road, Northern Territory, *R. Carolin 7937*, 24.8.1970 (NSW). ISOTYPE: SYD.

Herba erecta vel ascendens caulibus glabris vel pubescentibus sparse rigidis usque 40 cm altis. Folia basalia lincaria ad oblanceolata 1–6 cm longa plus minusve crassa plana vel involuta glabra integra basim versus contracta vel admodum sessilia. Folia caulina parviora involuta plerumque linearia. Flores in pedunculis 15–25 mm longis glabris vel pubescentibus sparse ebracteolatis articulatis pulvinatis ad basim divergentibus vel capsuliferis etiam reflexis in racemis terminalibus dispositi. Sepala lineari-lanceolata 1.5–2 mm longa. Corolla flava 8-12 mm longa simpliciter ac glandulose pubescens extus. Ovarium simpliciter ac glandulose pubescens dissepimento quartum longitudinem loculi aequanti. Indusium transverse late oblongum 1.5 mm longum villosum setis albidis 0.4 mm longis super labiis munitum. Capsula globularis 7 mm diametro duabus valvis integris dehiscens. Semina orbicularia circa 2.5 mm diametro ala 0.8–1 mm lata.

Erect to ascending herb to 40 cm high. *Leaves* both basal and cauline, linear to oblanceolate, 1–6 cm long, glabrous or with a few simple hairs towards the top, thick, flat or terete, dentate or entire, sessile or nearly so; cauline ones usually linear. *Flowers* arranged in terminal racemes on ebracteolate peduncles up to 25 mm long; the peduncles divergent or patent in the fruiting stage and usually persistent after the valves of the capsule have fallen. *Sepals* linear-lanceolate, 1.5–2 mm long, adnate to the ovary for half to two-thirds of its length. *Corolla* yellow, 8–12 mm long, glandular- and simple-pubescent outside, with a prominent anterior pouch; superior lobes with equal wings on either side, auriculate. *Ovary* glandular- and simple-pubescent with a dissepiment c. half as long as the loculus and bearing 6–14 ovules; style 4 mm long; indusium transverse-broad-oblong, 2 mm wide, villous on both surfaces with white bristles on the lips. *Fruit* globular, 7 mm diam., dehiscing through two entire valves. *Seeds* flattened, orbicular, c. 2.5 mm diam., grey, colliculate with a prominent rim and a wide wing.

This species would be placed in ser. *Pedicellosae* Benth. according to Krause's system. It resembles *G. armitiana* F. Muell., differing in having glabrous leaves and equal wings on the superior lobes of the corolla. It is known only from the Tanami Desert on the borders of the Northern Territory and Western Australia. The specific epithet refers to the appearance of the plant when the capsule valves have fallen from the pedicels; it then resembles a small shrub with bare twigs.

Goodenia triodiophila *Carolin*, **sp. nov.**

HOLOTYPE: 74 miles (118 km) from Tom Price on Yampire Gorge Road, Western Australia, *R. Carolin 7773*, 9.8.1970 (NSW). ISOTYPE: SYD.

Herba erecta vel ascendens ramosissima caulibus rigidis usque 40 cm altis glabra vel glabrescens basibus nonnunquam exceptis. Folia linearia 4–10 cm longa teretia involuta sessilia glabra pro parte maxima. Flores in pedunculis 8–30 mm longis ebracteolatis articulatis glabris vel apicem versus sparse glandulose pubescentibus, in racemis terminalibus dispositi. Sepala lineari-lanceolata usque ad anguste elliptico-oblonga 1.5–3 mm longa ad ovarium per 1/3–1/2 longitudinus eius affixa. Corolla flava 10–12 mm longa extus simpliciter ac glandulose pubescens intus simpliciter pubescens sacco prominenti ovarium aequanti instructa. Ovarium dissepimento circa dimidiam longitudinem loculi aequanti. Indusium depresse ovatum 1.5–1.8 mm longum glabrum vel villosum setis brevis 0.1–0.2 mm longis super labiis munitum. Capsula globularis usque ovoidea circa 6 mm diametro duabus valvis integris dehiscens. Semina orbicularia 6 mm diametro reticulata ala straminea 1–1.5 mm lata.

Much branched stiff ascending or erect herb to 40 cm high. Stems reddish or brownish and pubescent towards the base but becoming green and glabrous towards the top. *Leaves* linear, 4–10 cm long, terete, involute, sessile, lowest ones with a few simple hairs but upper ones usually glabrous. *Flowers* in terminal racemes on ebracteolate peduncles up to 30 mm long. *Sepals* lanceolate to narrow-elliptic-oblong 1.5–3 mm long adnate to the ovary for one-third to a half of its length. *Corolla* yellow, 10–12 mm long, glandular and simple-pubescent outside; anterior pocket prominent; superior lobes with ± equal wings, auriculate. *Ovary* simple- and glandular-pubescent with a dissepiment half as long as the loculus and bearing 20–25 ovules; style 5–6 mm long, glabrous or villous; indusium depressed-ovate, c. 3 mm wide, pubescent on both surfaces and with white bristles on the lips. *Fruit* globular to ovoid, c. 6 mm diam., dehiscing through two entire valves. *Seeds* flattened, orbicular, 4–6 mm diam., reticulate-alveolate with a prominent rim and a broad wing.

This species would be placed in ser. *Pedicellosae* Benth. in Krause's system. It resembles *G. arnhemiana* F. Muell. but can be distinguished by the glabrous, longer leaves and the branched main stem. It is a common species throughout central Australia; occurring in Western Australia, Northern Territory and Queensland. The specific epithet refers to the fact that it frequently grows in hummocks of *Triodia* spp.

Goodenia stellata *Carolin*, **sp. nov.**

HOLOTYPE: 73 miles (117 km) from Tom Price on Yampire Gorge Road, Western Australia, *R. Carolin 7770*, 9.8.1970 (NSW). ISOTYPE: SYD.

Herba decumbens vel prostrata pubescens pilis stellatis caulibusque usque 20 cm longis. Folia fere rosulata oblongo-elliptica usque ovata 4–8 cm longa 5–25 mm lata pubescentia crenato-dentata basim versus in petiolum plus minusve abrupte contracta: folia caulina similia sed parviora et fere sessilia. Flores in pedunculis pubescentibus ebracteolatis articulatis 10–20 mm longis, in racemis foliosis terminalibus dispositi. Corolla flava 12–15 mm longa stellate pubescens extus et basin versus simpliciter pubescens intus. Alae in margine utroque loborum corollae apicem vix attingentes eacque in marginibus inferioribus loborum superiorum auriculatae. Stylus 6–7 mm longus glaber indusio transverse oblongo 1–1.5 mm longo. Capsula globularis 6–7 mm diametro pubescens duabus valvis integris dehiscens. Semina orbicularia circa 4 mm diametro nigras nitidula reticulata ala et ora vix insignibus.

Decumbent to prostrate stellate-pubescent herb with stems to 20 cm long. *Leaves* mostly basal, oblong-elliptic to ovate, 4–8 cm long, crenate-dentate, obtuse, tapering ± abruptly into a short petiole; cauline leaves smaller and almost sessile. *Flowers* arranged in terminal leafy racemes on ebracteolate peduncles 10–20 mm long. *Sepals* lanceolate to narrow-oblong, c. 4 mm long. *Corolla* yellow, 12–15 mm long, stellate-pubescent outside with an obscure anterior pouch; superior lobes auriculate with a slightly narrower wing on the auricle side than on the other. *Ovary* with a dissepiment c. two-thirds the length of the loculus and bearing 25–30 ovules; style 6–7 mm long, glabrous; indusium with a few hairs scattered over the surfaces and white bristles on the lips. *Fruit* globular, 6–7 mm diam., dehiscing through two entire valves. *Seeds* flattened, orbicular, c. 4 mm diam., black, glossy, minutely reticulate with a scarcely differentiated wing.

This species is of doubtful position in Krause's classification but would possibly be placed in ser. *Foliosae* Benth. It differs from all other members of that series in having stellate hairs on the leaves. It is known from the Pilbara Region and Gibson Desert of Western Australia. The specific epithet refers to the stellate hairs that cover the plant.

Scaevola basedowii *Carolin*, **sp. nov.**

Holotype: Mt Unapproachable, South Australia, *H. Basedow 134*, 1.7.1926 (*K*). (Not the sheet marked 'SHT. 2 . . .').

Planta erecta ramosa suffruticosa ad 60 cm alta. Caules glandulose pubescentes atque pilis simplicibus paucis instructis. Folia ovata ad triangulares plerumque ad 8 mm longa pilis glandulosis simplicibusque. Flores plerumque solitares, in pedunculis ad 5 cm longis in axillis foliorum bracteolis duabis parvus triangularibus. Sepala pilis glandularibus instructa in dimidio inferiore connata, 2–3 mm longa tubo includentibus. Corolla alba sed lineis fuscis notata, ad 2.2 cm longa, intus barba longa densa et extus pilis arcuatis antrorsis simplicibus instructa. Ovarium pilis glandulosis simplicibusque munitum. Indusium setis numerosis fusco-albis idem aequantibus vel superantibus. Fructus siccite carnosus.

Erect subshrub to 60 cm high. *Stems* much-branched, glandular-pubescent and with some scattered stiff simple hairs, ± ridged. *Leaves* ovate to triangular, mostly less than 8 mm long, 1–3 mm wide, acute to bluntly acuminate, pubescent as the stems. *Flowers* borne in the axils of the upper leaves; peduncles up to 5 cm long, similar to the stems; bracteoles 2, triangular-ovate, c. 3 mm long, opposite or slightly displaced and inserted in the upper third of the pedunele. *Sepals* glandular-pubescent with very few simple hairs, connate into a tube 2–3 mm long surmounted by the lobes which are 1–1.5 mm long. *Corolla* 15–22 mm long, white with brownish lines, pubescent with stiff antrorse-arcuate to appressed simple hairs outside, densely bearded below the lobes inside; lobes oblong-elliptic, 5–7 mm long, 1.5 mm wide with a wing on either side c. 1 mm wide; tube 10–15 mm long. *Stamens* with filaments 5–7 mm long; anthers oblong, c. 2 mm long with a short flattened terminal appendage. *Ovary* covered with short glandular hairs and long stiff white patent simple hairs. *Fruit* dry, drupe-like, up to 5 mm diam.

Specimens Examined: Northern Territory: Mt Ziel—northern base, *G. W. Carr 1772 & A. C. Beauglehole 45501*, 13.6.1974 (SYD); 17 miles (27 km) S. of Mt. Wedge Station, *M. Lazarides 6062*, 19.9.1956 (NSW); Camp 17 and 18 Elder Exploring Expedition, *R. Helms* 10.7.1891 (NSW 83096).

This species would be placed in ser. *Pogonanthera* G. Don according to Krause's system, close to *Scaevola depauperata* R. Br. and can be distinguished from related species by the characters shown in Table 1.

The specific epithet refers to the collector of the type specimen, Herbert Basedow (1883–1933), a South Australian geologist and anthropologist who took part in a number of expeditions into northern South Australia and the Northern Territory.

TABLE 1

Diagnostic Features of *S.basedowii* and Related Species

Species	Indumentum on stems	Hairs on ovary and corolla	Calyx	Distribution
S. basedowii ..	glandular and simple	white, coarse	campanulate	N.T. & drier parts of W.A.
S. depauperata..	glabrous	white, short	campanulate	Qld, S.A., southern N.T.
S. parvifolia ..	simple ..	whitish, stiff	deeply divided	Qld., N.T., W.A., north of c. 26° 50′ S. latitude.
S. restiacea ..	glabrous	golden, short	deeply divided	W.A.

Coopernookia scabridiuscula *Carolin*, **sp. nov.**

HOLOTYPE: Cliffs on SE side of Mt. Maroon, Queensland, *M. Olsen 374*, 23.9.1976 (BRI 218131). ISOTYPE: (SYD).

Suffrutex ad 1 m alta. Folia anguste elliptica ad oblongo-elliptica (4–) 6–8 cm longa pilis glandulosis sed ubi adulta scabridiuscula. Flores in racemis bracteolatis basim ovarii vix excedentibus. Corolla malvina pilis stellatis et glandulosis extus 15–16 mm longa lobis ac fauce barbatis. Capsula seminaque ignota.

Weak branching shrub to 1 m high. Stems glandular hairy when young. *Leaves* narrow- to oblong-elliptic (4–) 6–8 cm long, 5–10 mm wide, glandular-pubescent when young but becoming minutely scabrid with age, dentate, acute to acuminate, base attenuate with a short indistinct petiole; margin slightly recurved particularly towards the base and apex. *Flowers* arranged in terminal leafy racemes; pedicels 10–15 mm long with two linear bracteoles which scarcely exceed the base of the ovary inserted about the middle, indistinctly articulated between the bracteoles. *Sepals* ovate to lanceolate, 5–6 mm long, 1.5–2 mm wide, acute, adnate to the lower half of the ovary, glandular-pubescent. *Corolla* "pink-purple", 15–16 mm long, stellate and glandular-pubescent outside, villous towards the base inside and with rows of long psuedo-hairs (barbulae) on the lobes and extending into the throat; superior lobes narrow-elliptic, 10–12 mm long, c. 1.5 mm wide with a wing c. 2 mm wide on either side making an obtuse angle at the apex; inferior lobes narrow-elliptic to oblanceolate, 9–10 mm long and c. 2 mm wide with a wing c. 2 mm wide and c. 6 mm long on either side; connate part of the inferior lobes c. 4 mm long; anterior pocket not very prominent but about half as long as the ovary. *Stamens* 5, free; filaments linear, 3–4 mm long; anthers oblong, 1.5 mm long, obtuse. *Ovary* glandular-pubescent with an almost obsolete dissepiment bearing 2–4 ovules; styles 9–10 mm long, villous; indusium depressed-ovate 1.5 mm long, 2–2.5 mm wide, villous with long white bristles on the lips. *Capsule and seeds* not seen.

This species has an apparently restricted distribution, and is distinguished from *C. barbata* by having broader and altogether larger leaves and shorter bracteoles; from *C. chisholmii* it differs in not having stellate hairs on the leaves. It is known only from the Mt. Maroon region in Queensland near the border with New South Wales.

SPECIMEN EXAMINED: QUEENSLAND: Mt Maroon, *S. L. Everist 7053*, 28.1.1962 (BRI 04427).

Verreauxia verreauxii (*De Vriese*) *Carolin*, **comb. nov.**

BASIONYM: *Dampiera verreauxii* De Vriese, Nat. Verh. Holl. Maats. Wet. Haarlem 10: 118, t. 20 (1854).

TYPE: *Verreaux* (P).

ABSOLUTE SYNONYM: *Verreauxia paniculata* Benth., Fl. Austral. 4: 105 (1869), *nom. superfl.*

TYPE: as for *Dampiera verreauxii*.

When Bentham described *V. paniculata* he listed *Dampiera verreauxii* De Vriese as a synonym and therefore the former is a superfluous name.

ACKNOWLEDGEMENTS

I would like to thank Dr L. A. S. Johnson for checking the Latin descriptions and Miss A. Graham for typing the manuscript.

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Manuscript received 5.9.1979

PLANTAGO MULTISCAPA, A NEWS PECIES FROM EREMAEAN AUSTRALIA, AND NOTES ON *PLANTAGO* IN WESTERN AUSTRALIA

Barbara G. Briggs

(Accepted for publication 14.3.1980)

ABSTRACT

Briggs, Barbara G. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. Plantago multiseapa, *a new species from eremaean Australia, and notes on* Plantago *in Western Australia. Telopea 2 (1): 77–81.—P. multiscapa* (sect. *Mesembrynia*) is allied to *P. drummondii* Decaisne and known from the south of the Northern Territory, adjoining parts of South Australia and the far north-west of New South Wales. A lectotype is selected for the Western Australian *P. exilis* Decaisne and the features distinguishing it from allied species are outlined. *P. varia* R. Br. var. *exigua* Pilger is referred to the synonymy of *P. debilis* R. Br.

A treatment of Plantaginaceae in New South Wales (Briggs, Carolin & Pulley, 1977) provides some information on the majority of *Plantago* species of the Australian mainland. The present paper deals largely with matters arising from that study but which could not be included in a State-limited treatment. Problems requiring more field study and collecting still remain, especially in the south of Western Australia and in South Australia.

In eastern Australia the distinctions between *Plantago* species, although generally reliable, often depend upon a number of very inconspicuous features. The same pattern appears to apply in Western Australia (see below, *P. exilis*). The highly distinctive *P. multiscapa* was omitted from the earlier treatment as it had not been recorded at that time from New South Wales.

(1) A new eremaean species

Plantago multiseapa *B. Briggs*, sp. nov.

Herba annua desertieola sectionis *Mesembryniae*. Seapi multi, (3–) 15–100 numerantes. Folia linearia (1–) 3–6.5 (–12) cm longa, 0.7–2 mm lata. Braeteae deltoideae non earinatae, virides vel aliquando fuseo-brunneae purpureaeve, marginibus membraneis, glabrae vel inconspicue pilosae. Capsula ellipsoidea, 3–3.6 mm longa, 1.8–2.4 mm lata, nitens, fuseo-brunnea, apice rotundata. Semina 4.

Annual herb with a long, usually straight taproot. *Leaves* numerous, all basal, erect or spreading, narrow-linear, (1–) 3–6.5 (–12) cm long, 0.7–2 mm wide, entire or occasionally with 1–2 inconspicuous teeth, thick and presumably fleshy when fresh, wrinkled and with an adaxial furrow when dry, coarsely (but often sparsely) pilose with short stout hairs, tapering very gradually to a slender base, the axil villous with white hairs 6–8 mm long, the apex blunt. *Scapes* numerous, (3–) 15–100 in number, (1–) 5–8 cm long, 0.5–1 mm diam., densely pilose with spreading or subappressed coarse hairs. *Spikes* very short or up to 4 cm long in fruit, with 2–26 flowers, compact in flowering stage but the lower flowers widely-spaced at fruiting stage. *Bracts* deltoid, 1.5–3 mm long, 1.2–1.8 mm wide, not keeled but with a broad thickened central zone $\frac{1}{2}$–$\frac{2}{3}$ of total width and membranous margins, green or rarely dark brown or purplish, glabrous or inconspicuously pilose with short hairs, the apex sometimes minutely ciliate. *Sepals* elliptic, 2.5–3 mm long, 1.8–2.5 mm wide, similar to bracts in texture, colour and indumentum. *Corolla:* tube 2–2.5 mm long; lobes deltoid, 0.8–1 mm long, 0.5–0.6 mm wide, with a median brownish stripe near base. *Stamens* with filaments scarcely exceeding the corolla tube; anthers 0.8 mm long. *Ovules* 4 or ?5, the apical ovule not apparent or very small and

aborted in fruiting stage. *Capsule* ellipsoidal, 3.0–3.6 mm long, 1.8–2.4 mm diam.; the lower persistent section not membranous and slightly exceeding the glossy, dark brown, upper section; the apex rounded, with a very small mucro (persistent style base). *Seeds* 4, yellow-brown, ellipsoidal, c. 2.3–2.8 mm long and 1.2 mm broad, flattened but slightly convex adaxially, with a thick mucilaginous layer.

HOLOTYPE: Sth Aust. Far North, Airstrip at Mokari Bore in Simpson Desert. Grid 448731, [26° 15′ S, 136° 25′ E], *D. E. Symon 9455*, 28-IX-1974 (AD). ISOTYPES: ADW, NSW, K.

DISTRIBUTION: Towards the south of the Northern Territory, the far north of South Australia and the extreme northwest of New South Wales (Fig. 1); on swales or claypans in sand-dune country, sometimes near watercourses. Most known occurrences are around the margins of the Simpson Desert. The single record from New South Wales was collected after several years of above-average rainfall but is in an area linked to the Simpson Desert by ± continuous sand-dune country.

SPECIMENS EXAMINED: NORTHERN TERRITORY: **Central Australian South:** 5 miles [8 km] SSW. of Mud Tank, 23° 01′ S, 134° 16′ E, *Latz 4332*, 14.9.1973 (NT); watercourse near Andado, *Crocker* [7.] 1939 (AD, the specimen is also labelled 'and sandhill along Eleanor, Camp 28', but this location apparently refers to a specimen of *P. drummondii*—there is an unambiguously labelled specimen of the latter from this locality in the Tate collection in AD).

SOUTH AUSTRALIA: **Lake Eyre Basin:** flat area between dunes 3 and 4, c. 38 miles [c. 61 km] E. of Dalhousie Springs, *Lothian 1544*, *1572*, 9.8.1963 (AD); 30 miles [c. 48 km] E. from base camp [base camp = c. 38 miles [c. 61 km] E. of Dalhousie Springs], *Lothian 1629*, 10.8.1963 (AD); 2 miles [c. 3 km] E. of base camp [E. of Dalhousie Springs], *Lothian 1847*, 12.8.1963 (AD).

NEW SOUTH WALES: **North Far Western Plains:** c. 1 km SE. of Middle Bore, Sturt National Park (formerly "Binerah Downs" station), *Mulham 1329*, 10.9.1978 (NSW).

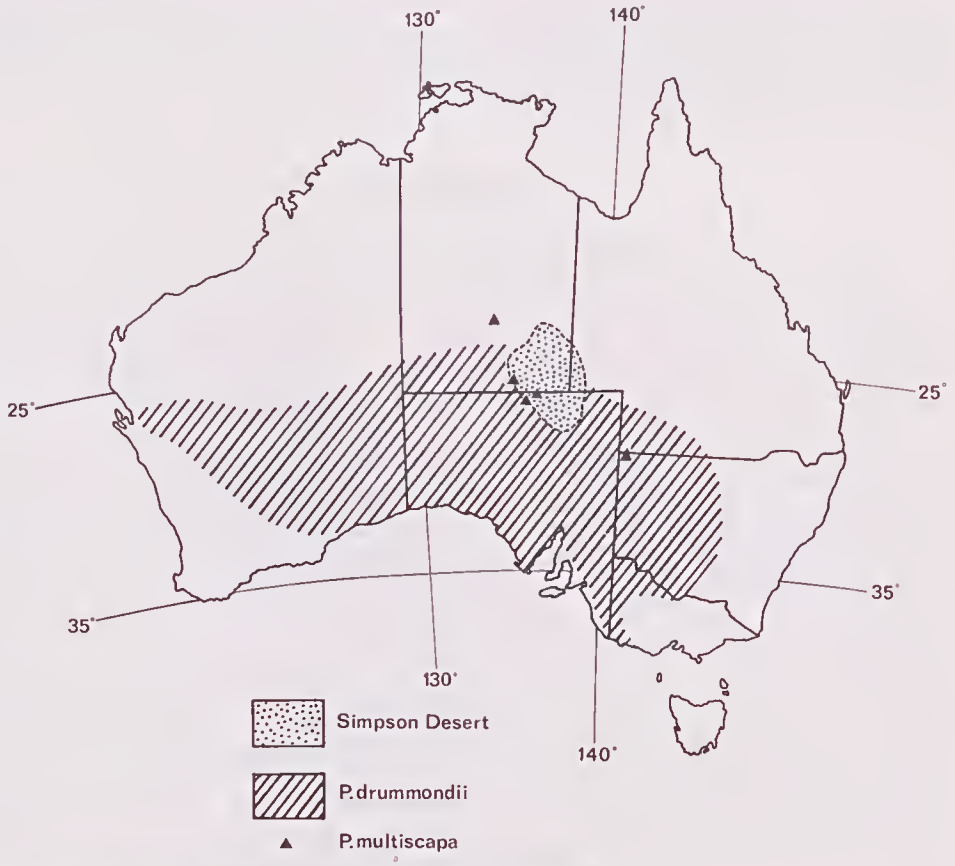

Fig. 1. Distribution of *Plantago multiscapa* and *P. drummondii*.

Eardley (1946) and Symon (1969) referred to material of *P. multiscapa* from the margins of the Simspon Desert under the name *P. varia* R. Br.

The annual species of arid and semi-arid Australia form a well-defined group consisting of *P. multiscapa*, *P. drummondii* Decaisne, *P. cunninghamii* Decaisne and *P. turrifera* Briggs, Carolin & Pulley. *P. multiscapa* is most similar to *P. drummondii* but differs in the rounded capsule apex, narrow leaves and usually very numerous scapes. The other species are treated by Briggs et al. (1977). These authors note that *P. cunninghamii* is intermediate in most features between *P. drummondii* and *P. turrifera* and suggest that *P. cunninghamii* may have originated by hybridization between those two species or, alternatively, that it may be ancestral to them. The features of *P. multiscapa* are not similarly derivable from any combination of those found in allied species. At one location (61 km E. of Dalhousie Springs) both *P. multiscapa* and *P. drummondii* have been collected.

As is commonly observed in this genus, diminutive plants are capable of flowering, presumably under unfavourable conditions. For instance, *Lothian 1629* includes a plant with only three fruiting scapes, scarcely 2.5 cm tall and bearing a total of only 6 flowers, but setting fruit and seeds of approximately normal size. Well-grown plants form large rosettes, up to 23 cm diam., with very numerous leaves and scapes.

(2) Features and status of *P. exilis*

Plantago exilis *Decaisne* in Candolle, Prodr. 13 (1): 702 (1852).

LECTOTYPE (here designated): N. Holl. –Riv. des Cygnes, *Preiss 1968*, 1843 [the protologue and the label on an isolectotype suggest that the date of collection was actually June 1839 and the isolectotype provides further locality information] (P. 2 sheets!, photos NSW, labelled as 'Plantago debilis R. Br. ex Nees' and 'exilis'). ISOLECTOTYPE: Swan River. In arenosis umbrosis sylvae prope oram maritimam Perth. *Preiss 1968*, June 1839, ex Herb. E. Drake (P).

Decaisne (l.c.) cites two collections of *P. exilis*, viz. *Preiss 1968* and *1969* The latter is from Rottnest (as Rotnest) Island but was apparently not seen by Pilger in his examination of specimens in P and I have not examined it.

This species, of sect. *Mesembrynia*, was synonymized under *P. varia* R. Br. by Pilger in Engler, Pflanzenr. 269, Heft. 102: 269 (1937); it has not generally been recognized in Australian Floras.

Perennial with a rather stout taproot. *Leaves* all basal, ± erect, narrow-elliptic, 8.5–23 cm long (including petiole which ± equals lamina), (0.4–) 1–2 cm wide, 3 (–5) nerved, thin-textured, pilose with spreading hairs, entire or usually with a few teeth (the teeth from shallow and very obtuse to prominent, retrorse and acute), the apex acute or obtuse, the base tapering very gradually to the slender petiole, the axil with inconspicuous pale brown hairs. *Scapes* 9–30 cm long, 0.6–1.8 mm diam., with an indumentum of soft short hairs spreading throughout or appressed on the upper half. *Spikes* (2–) 5–10 cm long, the lower flowers usually widely spaced in fruiting stage. *Bracts* narrow-elliptic or narrow-deltoid, 1.8–2.5 mm long, 0.7–1.5 mm wide, keeled, the thickened central zone c. ½ the total width, green or purplish, pilose or glabrous abaxially, the margins ciliate. *Sepals* broad elliptic, 2.6–4 mm long, 1.4–1.6 mm wide, keeled, the thickened and usually pilose central zone c. ¼ of the total width, green or purplish, the margins ciliate. *Corolla:* tube 2.6–3.8 mm long; lobes ovate-deltoid 1.6–2.5 mm long. *Stamens:* filaments c. 4.5 mm long, anthers 1.4–1.6 mm long. *Ovules* 5. *Capsule* ovoid-conical, pale, mostly obtuse with a short mucro, 2.8–3.5 mm long, 1.3–2.0 mm broad, the upper deciduous portion 2.2–2.6 mm long. *Seeds* yellow-brown ellipsoidal, 1–1.5 mm long, 0.8–1.2 mm broad, biconvex or flattened adaxially, the apical ovule commonly developing but often only a single seed in each of the lower loculi.

DISTRIBUTION: Recorded only from the Darling and Eyre districts of southern Western Australia.

SPECIMENS EXAMINED: WESTERN AUSTRALIA: **Darling:** Swan View (Perth), *Andrews*, 9.1901 (PERTH); Helena R., *Fitzgerald NSW 137344*, 9.1900 (NSW); North Fremantle, *Helms NSW 137342*, 7.1897 (NSW); Kelmseott, *Helms NSW 137340*, *NSW 137341*, 9.1898 (NSW); N. Holl.–Riv. des Cygnes [Swan R], *Preiss 1970*, 1843 (P. photo NSW) cited by Nees in Lehmann, Pl. Preiss, 1: 491 (1845) as 'in solo sublimoso prope Beljarup, Goderich, Octobri a 1840. Herb. Preiss No. 1970'. **Eyre:** Cranbrook, *Diels & Pritzel 490*, 10.1901 (PERTH); Gibson, N. of Esperanee, *Royee 3750*, 8.1950 (PERTH).

P. exilis shows general resemblance to *P. debilis* R. Br. in leaf and scape number and dimensions, as well as in leaf texture. However, the rootstock, floral dimensions and some other features suggest closer affinity to *P. hispida* R. Br. (Table 1).

TABLE 1

Features of *P. exilis* and of allied Australian species (principal features distinguishing other species from *P. exilis* in *italics*).

	exilis	*hispida*	*debilis*	*varia*
Taproot	stout	stout	*usually slender*	stout
Leaves	narrow-elliptic	narrow-elliptic to oblaneeolate	*oblaneeolate* or *obovate*	narrow-elliptic
Leaf length ..	8.5–23 cm	*(2–) 4–9 (–16) cm*	3–15 (–25) cm	6–20 cm
Axillary hairs ..	pale brown	white or pale yellow-brown	pale brown	*reddish brown*
Hairs on lower ½ of scape.	spreading	spreading or ± *appressed*	*appressed*	± *appressed*
Hairs on adaxial surface of leaf.	stout but soft	*slender*	*slender*	*slender*
Sepal length ..	2.6–4 mm	2.2–2.8 (–3.0) mm	*1.5–2.2 (–3.0) mm*	2.8–3.5 (–4.0) mm
Length eorolla lobes. ..	1.6–2.5 mm	*1.3–1.5 mm*	*0.8–1 mm*	1.5–2.3 mm

(3) *P. varia* var. *exigua*: a synonym of *P. debilis*

Plantago varia *R. Br.* var. **exigua** *Pilger* in Engler, Pflanzenr. 269, Heft 102: 269 (1937).

HOLOTYPE: Nouvelle Holl. Swan R., *Mr James Drummond 714* (G). This was eompared with Lakeside, SW. of Cue, *W. V. Fitzgerald* 8.1898 (NSW 102421) by G. Chippendale (letter 16.3.1973) who notes that NSW 102421 'is an exact match for Drummond's speeimen in size, appearanee and vestiture, and also in the shape and size of the sepals'.

Probable Isotype: Swan River, *Drummond* 1839 (K), also reported by Chippendale as an excellent mateh for NSW 102421.

Reference was made to this variety by Briggs, Carolin & Pulley (1977), noting that it appeared speeifieally distinet from *P. varia* R. Br. 'but the name *P. exigua* is preoeeupied and a new name will be published elsewhere'. I have now examined further specimens and consider that *P. varia* var. *exigua* is probably a synonym of *P. debilis* R. Br., not deserving recognition at either specific or subspecific rank.

In Western Australia, as elsewhere, the name *P. varia* has been misapplied to several species, including *P. debilis*. The former is a species of eastern Australia, occurring mainly in the cooler tableland and southern regions. *P. debilis* appears not to have been recorded in Western Australia in recent publications. Collections are few but widely scattered in the phytogeographic regions (Beard, 1979) of Austin (Gibraltar, Lakeside), Irwin (Houtmans Abrolhos and Mingenew), Drummond (Garden Is.), and Eyre (Jacup SW. of Ravensthorpe). The last locality is the only one accompanied by a habitat note, 'among grass in shady valley', consistent with habitats of *P. debilis* in eastern Australia.

Western Australian specimens are smaller, narrower-leaved, and with inflorescences more compact and more pilose than is usual in *P. debilis* elsewhere, but no fully consistent differences have been noted. These specimens closely resemble depauperate plants of *P. hispida* R. Br. but differ in their apparently annual habit, slender taproot, narrower petals, smaller anthers and more membranous capsule. Both species include occasional subglabrous plants, particularly in sea-coast sites. *P. hispida* is known from southern Western Australia, east of Albany (Pallinup River, Lort River, and Cape Le Grand).

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I wish to thank Mr George Chippendale of the Division of Forest Research, CSIRO, Canberra, for examining and reporting upon type material at K and G. I am also indebted to the late Mr John Carrick of the State Herbarium of South Australia for assistance in the typification of *P. exilis*. The loan of specimens from or opportunity to examine material at P, K, AD, ADW, and PERTH is gratefully acknowledged.

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Manuscript received 2.11.1979

NOTES ON CASUARINACEAE

L. A. S. Johnson

(Accepted for publication 14.3.1980)

ABSTRACT

Johnson, L. A. S. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. Notes on Casuarinaceae. Telopea 2 (1): 83–84.—In this precursory note, the new genus *Gymnostoma* and one new species, *G. vitiense*, are described; a new combination is made for *G. nodiflorum* (Thunb.) L. A. S. Johnson. The use of *Casuarina equisetifolia* is briefly discussed.

1. GYMNOSTOMA

In a treatment in preparation, I shall give reasons for recognizing four genera in the Casuarinaceae. As a precursor to Volume 2 of Professor A. C. Smith's 'Flora Vitiensis Nova', it is necessary to establish one of the new genera in advance and to describe the single Fijian endemic species.

Gymnostoma *L. A. S. Johnson*, **gen. nov.**

Ramuli persistentes novelli eis deciduis similes; ramuli omnes quadricostati, sulcis intercostalibus apertis non profundis, seriebus stomatum expositis. Folia 4 in verticillo unoquoque. Spiculae florum maseulorum in ramulis floriferis eis vegetativis non valde distinctis dispositae, simplices vel aspectu compositae ramificationis condensatione; spiculae femineae in ramulis brevibus elongatisve sed aspectu eis vegetativis similibus dispositae. Infructescentiae plerumque inter ramulos assimilantes dispositae; bracteae distaliter expansae facie abaxiali infra apicem verticali manifestaque, latiore quam altiore; bracteolae protrudentes in dorso convexae sed nec fissae nec protuberatione instructae. Chromosomata ut cognita $n = 8$.

Persistent branchlets similar, as new shoots, to the deciduous branchlets; all branchlets 4-ribbed, the intercostal furrows shallow and open, exposing the stomates. *Leaves* in whorls of 4. *Male inflorescences* borne on branchlets differing little from the vegetative ones, simple or appearing compound owing to condensation of branching; *female inflorescences* borne on branchlets that are short or elongated but similar in aspect to vegetative branchlets. *Infructescences* ('cones') mostly borne amongst the assimilatory branchlets; bracts expanded distally with the abaxial surface vertical below the apex and broader than high; bracteoles protruding, convex on the back but neither split nor furnished with a protuberance. *Chromosome number* $n = 8$, so far as known.

Species typica: *G. nodiflorum* (Thunb.) L. A. S. Johnson (*Casuarina nodiflora* Thunb.).

18 species, from Malesia to N.E. Australia, Fiji, and New Caledonia.

The name is derived from Greek *gymnos* = naked, and *stoma* = mouth, referring to the exposed position of the stomata on the branchlets. Poisson (1874, p. 103) recognized a 'Divisio' *Casuarinae Tetragonae* seu *Gymnostomae*, but the new genus is not formally based on Poisson's taxon.

Gymnostoma nodiflorum (*Thunb.*) *L. A. S. Johnson*, **comb. nov.**—*Casuarina nodiflora* Thunb., Nova Genera Plantarum: 54 (1782), *Basionym*. Holotype: New Caledonia, *Forster* (UPS).

This New Caledonian endemic will be discussed in the paper in preparation. The name *Casuarina nodiflora* has been widely misused.

Gymnostoma vitiense *L. A. S. Johnson*, **sp. nov.**

Ramuli rigidiusculi plus minusve erecti; articuli 3–5 mm longi, 0.5–0.8 mm diametro, ei ramulorum paenultimorum saepe valde abbreviati in regionibus ramuliferis; laminae foliorum (dentes) brevissimae (0.2–0.3, rare 0.5 mm longae), ovato-deltoideae arcte incurvae; inflorescentiae masculae (ut videtur) subcompositae 1–5 mm longae; infructescentiae mediocres, corpore (bracteolis exclusis) 14–23 mm longo, 11–20 mm diametro, bracteis bracteolisque longitudinaliter striatis.

Branchlets rather rigid, more or less erect; articles 3–5 mm long, 0.5–0.8 mm diam., those of the penultimate branchlets often much abbreviated in the branchlet-bearing regions; leaf-laminae ('teeth') very short (0.2–0.3, rarely to 0.5 mm long), ovate-deltoid and strongly incurved; male inflorescences (so far as seen) sub-compound, 1–5 mm long; infructescences ('cones') medium-sized, the body (excluding the bracteoles) 14–23 mm long, 11–20 mm diam., the bracts and bracteoles longitudinally striate.

HOLOTYPUS: Viti Levu: Naitasiri: Colo-i-Suva, *L. A. S. Johnson NSW 143813*, 20.8.1969; ♀ with mature infructescences.

The name *Casuarina nodiflora* has generally been misapplied to this species in Fiji, where it is endemic. It will be discussed more fully later.

2. *Casuarina equisetifolia*

Fosberg & Sachet (1975) have taken up the name '*Casuarina litorea* L.' in place of *C. equisetifolia* for this widespread and very well-known tropical and subtropical species. They also attribute the generic name *Casuarina* to Linnaeus, citing 'Diss. Stickman, 12, 1954 [as *Casaarina*, sphalm.]' as the place of publication.

I have in preparation a detailed discussion of the very complex nomenclatural problems presented by this case and others related to it. The present note is merely to indicate that there is a substantial case against the interpretation of Fosberg and Sachet, and for the retention of the name *Casuarina equisetifolia* Forst. et Forst. f. This case rests on the interpretation of the International Code of Botanical Nomenclature (Stafleu et al., 1978) and not on any *ad hoc* proposal to outlaw the Stickman dissertation. Consequently, I recommend strongly that the name *Casuarina equisetifolia*, being in current use, be retained, at least until the counter-argument to Fosberg and Sachet has been fully considered.

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Manuscript received 20.2.1980

Telopea 2 (0): 85–112, figs 1–13 (1980)

SEED SURFACE STRUCTURE IN THE GENUS *ZIERIA* SM. (RUTACEAE)

J. M. Powell and J. A. Armstrong

(Accepted for publication 14.3.1980)

ABSTRACT

Powell, J. M. and J. A. Armstrong (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, New South Wales, Australia 2000) 1980. Seed surface structure in the genus Zieria *Sm. (Rutaceae). Telopea 2 (1): 85–112.*—Seed surface structure of 119 samples representing 23 species of *Zieria* is examined, using the scanning electron microscope. Forty surface patterns are distinguished; thirty-eight are ridged, one is tuberculate and one colliculate-ribbed. The ridged surface patterns can be classified into three major groups and a number of subgroups on the basis of structural similarities. The taxonomic significance of the seed surface morphology is assessed by comparison with newly circumscribed taxonomic entities recognized on other morphological grounds by Armstrong. There is considerable concurrence between the seed data and the taxonomic entities but it is not universal. It is concluded that seed surface features provide a useful basis for distinguishing species and subspecies in only some instances within this genus. The close relationship indicated by general morphology within certain groups of taxa is supported by the seed data although, in general, phylogenetic conclusions cannot be based solely on seed surface structure.

INTRODUCTION

The genus *Zieria*, comprising some 27 species, is predominantly eastern Australian in distribution, extending from NE. Queensland to Tasmania and as far west as Kangaroo Island in South Australia; one species is endemic in New Caledonia. Bentham (1863) distinguished 10 species; since then a number of other taxa have been defined (Mueller 1875; Domin 1913; Maiden & Betche 1911, 1916; White 1932, 1942; Blakely 1941). The genus is being revised by Armstrong as part of a broader biosystematic study of the tribe Boronieae (Rutaceae).

Traditionally fruit and seed characters such as the fruit type (drupe, berry, capsule, samara), the number of cells in the fruit, the persistence or otherwise of the endocarp and the presence or absence of endosperm have been used in delimiting subfamilies and tribes within the Rutaceae (Bentham 1863; Engler 1931, 1964), but relatively little attention has been paid to seed surface structure.

Recent scanning electron microscope studies have provided detailed information on the surface patterns of small fruits and seeds (Heywood 1969, 1971) and have provided a firm base for the separation of closely related species in some genera e.g. *Carex* (Toivonen & Timonen 1976), *Cocculus* (Forman 1974), *Epilobium* (Seavey et al. 1977b), *Erica* (Huekerby et al. 1972), *Mentzelia* (Hill 1976) and *Scirpus* (Schuyler 1971), and for distinguishing subspecies and varieties within others, e.g. *Arenaria* (Ehlin 1968) and *Cochlearia* (Godeau 1973a, b). Seed surface patterns are considered to be significant at higher taxonomic levels (sections, tribes, etc.) in *Cordylanthus* (Chuang & Heckard 1972), *Epilobium* (Skvortsov & Rusanovitch 1974; Seavey et al. 1977a) and *Sagina* (Crow 1979), and have been used for assessing relationships in *Scirpus* (Schuyler 1971), in *Mentzelia* (Hill 1976) and in the Melastomataceae (Whiffin & Tomb 1972). Much of the data available has been reviewed by Brisson & Peterson (1976).

An initial survey of *Zieria* seeds revealed various surface patterns and indicated a detailed study would be worthwhile. The aims of the study were, firstly, to describe in detail the seed surface patterns found in *Zieria* and to elucidate inter- and intra-specific variability, and secondly, to assess the usefulness of the seed data for taxonomic purposes.

TABLE 1

Voucher details of *Zieria* specimens studied

Sample Number	Taxon (Armstrong unpubl.)	Name used at NSW in 1975	Collector & No.
1	*Zieria arboreseens* ssp. '*a*'	Z. arboreseens Sims	Blake 23715 (BRI)
2	,,	,,	Close NSW 2770
3	,,	,,	Doney NSW 30526
4	,,	,,	French MEL 61977
5	,,	,,	Garden NSW 7311
6	,,	,,	Jacobs 51 (MEL)
7	,,	,,	Maiden NSW 2773
8	,,	,,	Merrall MEL 61989
9	*Zieria* sp. nov. '*F*'	Z. sp. aff. arborescens	Armstrong 115 (NSW)
10	,,	,,	Armstrong 744 (NSW)
11	,,	,,	Rodway NSW 19748
12	*Zieria aspalathoides* ssp. '*a*'	Z. aspalathoides A. Cunn. ex Benth.	Armstrong 999 (NSW)
13	,,	,,	Armstrong 1030 (NSW)
14	,,	,,	Biddulph 47 (BRI)
15	,,	,,	Clemens BRI 021762
16	,,	,,	Henderson 706 (BRI)
17	,,	,,	Henderson 1206 (BRI)
18	,,	,,	Streimann 631 (CBG)
19	,,	,,	Streimann 633 (CBG)
20	*Z. aspalathoides* ssp. '*b*'	,,	Boorman NSW 2725
21	,,	,,	Forsyth NSW 2734
22	,,	,,	Streimann 678 (CBG)
23	*Z. aspalathoides* ssp. '*c*'	,,	Gittins 919 (BRI)
24	,,	,,	Henderson 1098 (BRI)
25	*Zieria* sp. nov. '*A*'	Z. aspalathoides var. obovata C.T. White	Armstrong 1025 (NSW)
26	,,	,,	Fitzalan MEL 62269
27	,,	,,	Telford NQ 750 (CBG)
28	*Zieria* sp. nov. '*B*'	Z. aspalathoides var. nov. '1'	Costin NSW 10525
29	*Zieria chevalieri*	Z. chevalieri Virot	McKee 5559 (NSW)
30	*Zieria fraseri* ssp. '*b*'	Z. compacta C. T. White	Armstrong 669 (NSW)
31	,,	,,	Jones CANB 189291
32	,,	,,	McKee 455 (MEL)
33	,,	,,	McKee NSW 22018
34	,,	,,	Pedley 1175 (BRI)
35	,,	,,	Streimann 575 (CBG)
36	*Zieria cytisoides* ssp. '*a*'	Z. cytisoides Sm.	Boorman NSW 2977
37	,,	,,	Constable 5168 (NSW)
38	,,	,,	Gittins 351 (BRI)
39	,,	,,	Rodway NSW 19727
40	,,	,,	Williamson MEL 62033
41	*Zieria cytisoides* ssp. '*b*'	,,	Burgess CBG 020402
42	,,	,,	Phillips CBG 005925
43	,,	,,	Phillips CBG 002887
44	,,	,,	*Anon.* MEL 62038
45	*Zieria furfuracea* ssp. '*a*'	Z. furfuracea R.Br. ex Benth.	Armstrong 551 (NSW)
46	,,	,,	Maiden NSW 2787
47	*Zieria furfuracea* ssp. '*b*'	,,	King s.n. (Coffs Harbour)
48	,,	,,	White BRI 021724
49	,,	,,	*Anon.* BRI 021725
50	*Zieria granulata*	Z. granulata (F.Muell.) C. Moore ex Benth. var. granulata	Boorman NSW 2855
51	,,	,,	Camfield NSW 2851
52	,,	,,	Camfield BRI 021617
53	*Zieria* sp. nov. '*C*'	Z. granulata var. adenodonta F.Muell.	*Anon.* MEL 62068
54	,,	,,	Carron MEL 62069
55	,,	,,	White 11876 (BRI)
56	*Zieria involucrata*	Z. involuerata R.Br. ex Benth.	Armstrong 804 (NSW)
57	,,	,,	Hamilton NSW 55952
58	*Zieria laevigata* ssp. '*a*'	Z. laevigata Sm.	Armstrong 750 (NSW)
59	,,	,,	Bäuerlen 126 (MEL)

TABLE 1—*continued*

Sample Number	Taxon (Armstrong unpubl.)	Name used at NSW in 1975	Collector & No.
60	*Zieria laevigata* ssp. '*a*'	Z. laevigata Sm.	Cheel NSW 2914
61	,,	,,	Garden NSW 4436
62	,,	,,	Garden NSW 4437
63	*Zieria fraseri* ssp. '*a*'	Z. laevigata var. fraseri (Hook.) Domin	Telford CBG 050542
64	*Zieria* sp. nov. '*D*'	Z. sp. aff. laevigata	Rupp NSW 13578
65	*Zieria laevigata* ssp. '*b*'	Z. laxiflora Domin	Armstrong 1160 (NSW)
66	,,	,,	Aston 89 (MEL)
67	,,	,,	Cheel NSW 2923
68	,,	,,	Clemens BRI 021624
69	,,	,,	Clemens BRI 021649
70	,,	,,	Clemens BRI 021650
71	,,	,,	Everist 7693 (CANB)
72	,,	,,	Hubbard 3905 (MEL)
73	,,	,,	Coveny 3808 (NSW)
74	,,	,,	White 6303 (BRI)
75	,,	,,	White 7105 (BRI)
76	*Zieria minutiflora* ssp. '*a*'	Z. minutiflora (F.Muell.) Domin	Dowling 17 (BRI)
77	,,	,,	Hunt BRI 118401
78	,,	,,	Moriarty 136 (BRI)
79	,,	,,	Simmonds BRI 111807
80	,,	,,	Telford 715 (CBG)
81	,,	,,	Hubbard 4116 (BRI)
82	*Zieria minutiflora* ssp. '*b*'	,,	Stevens QRS 000280
83	*Zieria murphyi*	Z. murphyi Blakely	Armstrong 212 (NSW)
84	,,	Z. pilosa var. eanescens (R.Br.) Benth.	Caley s.n. (BM)
85	*Zieria obcordata*	Z. obcordata A.Cunn.	Ingram NSW 75929
86	*Zieria pilosa*	Z. pilosa Rudge	Armstrong 1257 (NSW)
87	,,	,,	Blakely NSW 2871
88	,,	,,	Briggs 3960 (NSW)
89	,,	,,	Camfield NSW 2884
90	,,	,,	Camfield NSW 2879
91	,,	,,	Fletcher NSW 2883
92	*Zieria robusta*	Z. robusta Maiden et Betche	Cambage 3180 (NSW)
93	*Zieria smithii* ssp. '*a*'	Z. smithii Andr.	Beekler MEL 62203
94	,,	,,	Boorman NSW 2560
95	,,	,,	Boorman NSW 2984
96	,,	,,	Cheel NSW 2979
97	,,	,,	Constable 5570 (NSW)
98	,,	,,	Constable NSW 56031
99	,,	,,	Durrington BRI 152495
100	,,	,,	Garden NSW 17247
101	,,	,,	Maiden NSW 3014
102	,,	,,	Phillips CBG 023871
103	,,	,,	Salasoo 2851 (NSW)
104	,,	,,	Seur 122 (NSW)
105	*Zieria smithii* ssp. '*b*'	,,	Armstrong 750 (NSW)
106	,,	,,	Armstrong 1020 (NSW)
107	,,	,,	Johnson MEL 62220
108	,,	,,	Tryon BRI 021697
109	,,	Z. sp. nov '1'	Smith 3389 (BRI)
110	*Zieria* sp. nov. '*E*' ssp. '*a*'	Z. smithii Andr.	Everist 1169 (BRI)
111	*Zieria* sp. nov. '*E*' ssp. '*b*'	,,	Flecker QRS 000285
112	*Zieria* sp. nov. '*E*' ssp. '*c*'	,,	Armstrong 1032 (NSW)
113	,,	,,	Brass 20113 (BRI)
114	*Zieria veronicea*	Z. veronieea (F.Muell.) Benth.	Eichler 15176 (AD)
115	,,	,,	Eichler 18545 (AD)
116	,,	,,	Kraehenbuehl 1305 (AD)
117	,,	,,	Sutton MEL 62250
118	,,	,,	*Auon.* AD 96248108
119	*Zieria* sp. nov. '*G*'	Z. sp. nov. '11'	Johnson MEL 62275

No seed samples were available of *Z. arborescens* ssp. '*b*' to ssp. '*f*', *Z. furfuracea* ssp. '*c*', *Z. smithii* ssp. '*c*', *Z.* sp. nov. '*H*' to '*K*'.

MATERIALS AND METHODS

Seeds used in the study were taken mainly from herbarium specimens deposited at the National Herbarium of New South Wales (NSW), and on loan from AD, BM, BRI, CANB, CBG, Coffs Harbour, MEL, and QRS. Some samples were taken from field collections and a few were obtained from living material grown in the research collection at the Royal Botanic Gardens, Sydney. Voucher specimens for these are held at NSW.

Since seed coat structure could be expected to differ at different stages of maturity, both immature and apparently mature seeds were selected for study. Samples were taken initially from the taxa recognized at NSW in 1975, i.e. prior to the start of the taxonomic revision. As the revision progressed, it became the taxonomic base for further sampling. The specimens studied are listed in Table 1 under both the earlier and more recent names (Armstrong, unpubl.).

Seed coat patterns were observed initially at 10–40x magnification using an Olympus stereomicroscope. For more detailed study seeds were mounted on specimen stubs with double-stick cellophane tape or with conductive silver paint. The specimens were then vapour-coated with 200–400 Å thickness of gold in a Polaron Coating Machine before being examined and photographed with a Cambridge Mark IV A Stereoscan Electron Microscope.*

All parts of the surface were studied in a detailed and systematic manner at magnifications between 50x and 5000x. Any variation of pattern from one part of the seed to another was noted. For comparative work, photographs were taken of the central area of the seed surface near the middle of the seed and occasionally also near the apex or base of the seed. Photomicrographs were standardized at 240x and 600x magnification for later study.

Because of the brittle seed coat it was impractical to prepare transverse sections for light microscopy and so scanning electron microscopy of transversely-fractured seeds was undertaken.

Surface pattern components

Most *Zieria* seed surfaces can be described in general terms such as rugulose, colliculate or tuberculate (Murley 1951) at magnifications up to c. 40x (Fig. 1A, B) but at much higher magnifications (100–600x or more) the surface pattern is too complex to portray in such terms.

To facilitate descriptions the following components of the patterns are described separately:

Ridges may be present or absent. When present they may be well-developed and either prominent and crested (i.e. rising high above the inner-ridge surface but sloping to it, Fig. 2A, B), prominent and erect (i.e. rising vertically above the ridge surface, Fig. 2D), or not prominent (i.e. not well-developed, Fig. 2C). The ridges may be continuous over most of the seed length (2000–4500 μm) or short, only 30–40 μm in length in some instances; they may have few or many branches and cross-ridges (Fig. 2F, G). In structure they may appear single (Fig. 3A, B) or be clearly double (Fig. 3C–F). Ridge width varies greatly from very narrow (less than 7 μm across) to extremely broad (greater than 28 μm across) and the distance between ridges varies greatly also, in some instances being less than 20 μm, in others over 100 μm. Individual *ridge units* (Fig. 3A–F) may be distinct or indistinct, rectangular or oval in shape and have a smooth or patterned surface.

* Located at the Electron Microscope Unit, School of Biological Sciences, University of New South Wales.

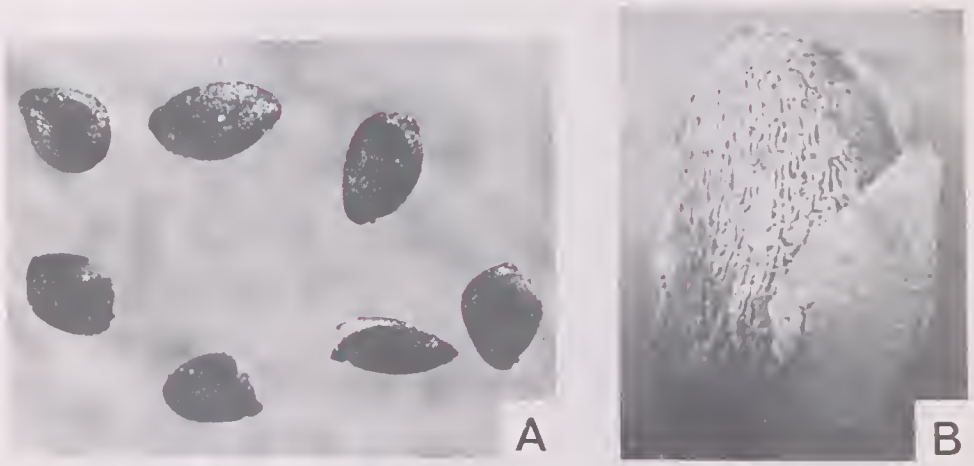

Fig. 1. *Zieria* seeds. A. Variation in size and shape, x 7. B. Seanning electron micrograph of whole seed with elaiosome attaehed, x 20.

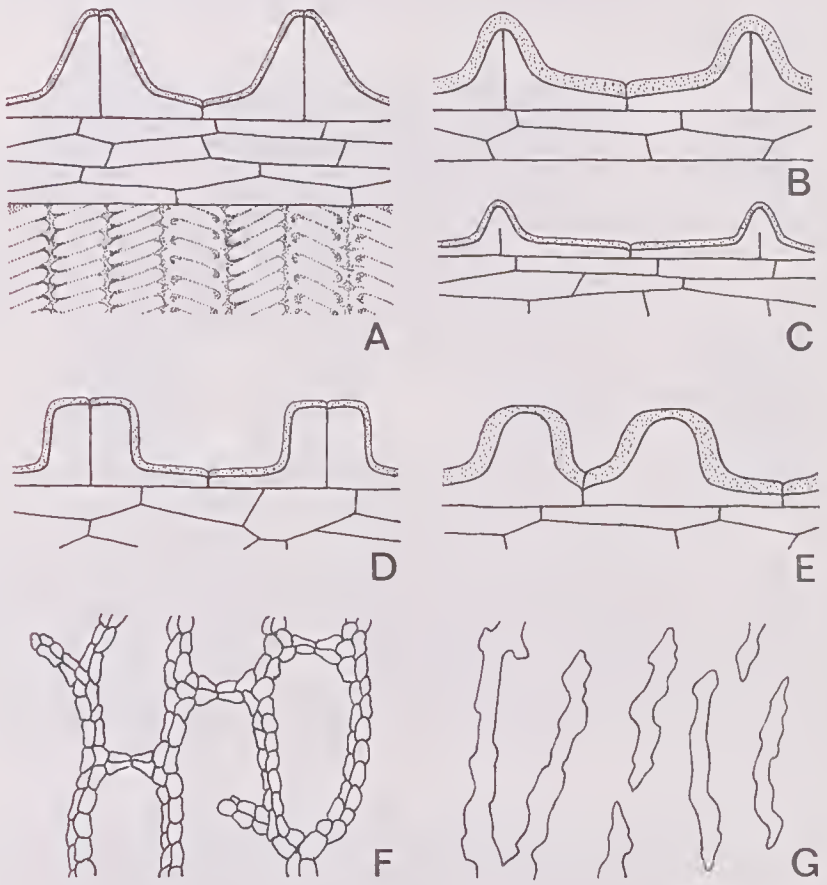

Fig. 2. Seed strueture in *Zieria*. A–D. *Transverse sections showing ridge types*. A, B. Well-developed, prominent, erested. C. Not well-developed. D. Well-developed, prominent, ereet. E. *Transverse section* of tubereulate seed. F–G. *Surface features of ridges*. F. Ridges long, with many braneh es and eross-ridges. G. Ridges short, with few braneh es and no eross-ridges.

An *inter-ridge pattern* (Fig. 3G–I) may be present or absent; if present it may be distinct or indistinct. The inter-ridge units can be described in terms of their shape and size, namely long-rectangular (usually 35–45 μm long, 15–18 μm wide; Fig. 3G), rectangular (usually 25–35 μm long, 15–18 μm wide), short rectangular or almost square (usually 15–25 μm across), triangular (18–24 μm per side; Fig. 3H) and oval to round (15–25 μm across; Fig. 3*I*). The units may be arranged somewhat irregularly between the ridges or aligned in 2–5 transverse rows. The *inter-ridge surface* may be ribbed (with the margins of the long-rectangular or rectangular units sunken, the centres raised; Fig. 3J), colliculate (with the margins of the short rectangular, triangular or oval units sunken, the centres raised; Fig. 3K), undulate (with the margins of the units—usually oval, triangular or short-rectangular—raised, the centres sunken; Fig. 3L), flat, concave or rugose. The inter-ridge *unit surface* may be smooth or patterned in various ways; it may be weakly striate or flecked (Fig. 3M), strongly striate (Fig. 3J), finely scabrate (Fig. 3K), coarsely scabrate (Fig. 3N), rugose, or coarsely scabrate-striate (Fig. 3*O*). *Wax* may be present or absent on the surface between the ridges; if present it may be sparse, common or abundant, persistent or non-persistent. The wax may appear as large flakes (Fig. 3P), crystals (Fig. 3Q), compact flocs or powdery flocs (Fig. 3R).

Slight changes in surface pattern often occur towards the edges of the seeds; the size of the units may vary somewhat and the regularity of the pattern decreases. The descriptions cover the range of pattern present over the major portion of the dorsal and ventral surfaces.

OBSERVATIONS AND DISCUSSION

Forty seed surface patterns can be described from the 119 samples of seed available for study; these are illustrated in Figures 4–13. Thirty eight types are ridged; within these considerable diversity in detailed pattern can be discerned with the scanning electron microscope and an attempt has been made to analyse this pattern both quantitatively and qualitatively (Tables 2–5). The other two types are very distinct: one is colliculate-ribbed (pattern 39, Fig. 13E, F), the other tuberculate (pattern 40, Fig. 13G, H). Detailed descriptions of mature and immature seed surface patterns, together with all photographs, are held at NSW.

Ridged surface patterns

(1) Criteria used for comparisons

For comparative purposes the most useful criteria are ridge width and length, spacing of ridges and the frequency of branches and cross-ridges since these can be measured directly or readily assessed qualitatively. In mature seeds the surface sculpture appears to be formed from the upper layer of 3–4 transverse cell layers which overlay a broad, hard, columnar cell layer (Fig. 2A–D). The ridges comprise vertical projections of parts of two adjoining cells. Ridge heights vary from 10 μm (sample 80, pattern 13) to 60 μm (sample 61, pattern 2) with from 30% (sample 93, pattern 22) to 80% (sample 61, pattern 2) of the total length of the cell upright. The cutin covering the cells varies somewhat in thickness and in sample 56 (pattern 15) obscures the underlying double structure of the ridge (Fig. 2B). In the tuberculate-patterned seed (sample 86, pattern 40) each tubercle is a single cell covered by very thick cutin (Fig. 2E).

The inter-ridge pattern in most cases is constant but in some varies from one part of the seed to another, e.g. in seed samples 21 (pattern 9), 64 (pattern 7) and 73 (pattern 8) the inter-ridge surface is ribbed in some areas but flat in others. In sample 93 (pattern 22) and sample 100 (pattern 24) the inter-ridge pattern is more ribbed towards the side of the seed and in sample 98 (pattern 26) the ridges are very poorly developed in parts. Assessment of inter-ridge pattern development, structure, and surface is relatively easy in seeds that lack wax; in those with wax, assessment of these criteria depends upon finding wax-free areas.

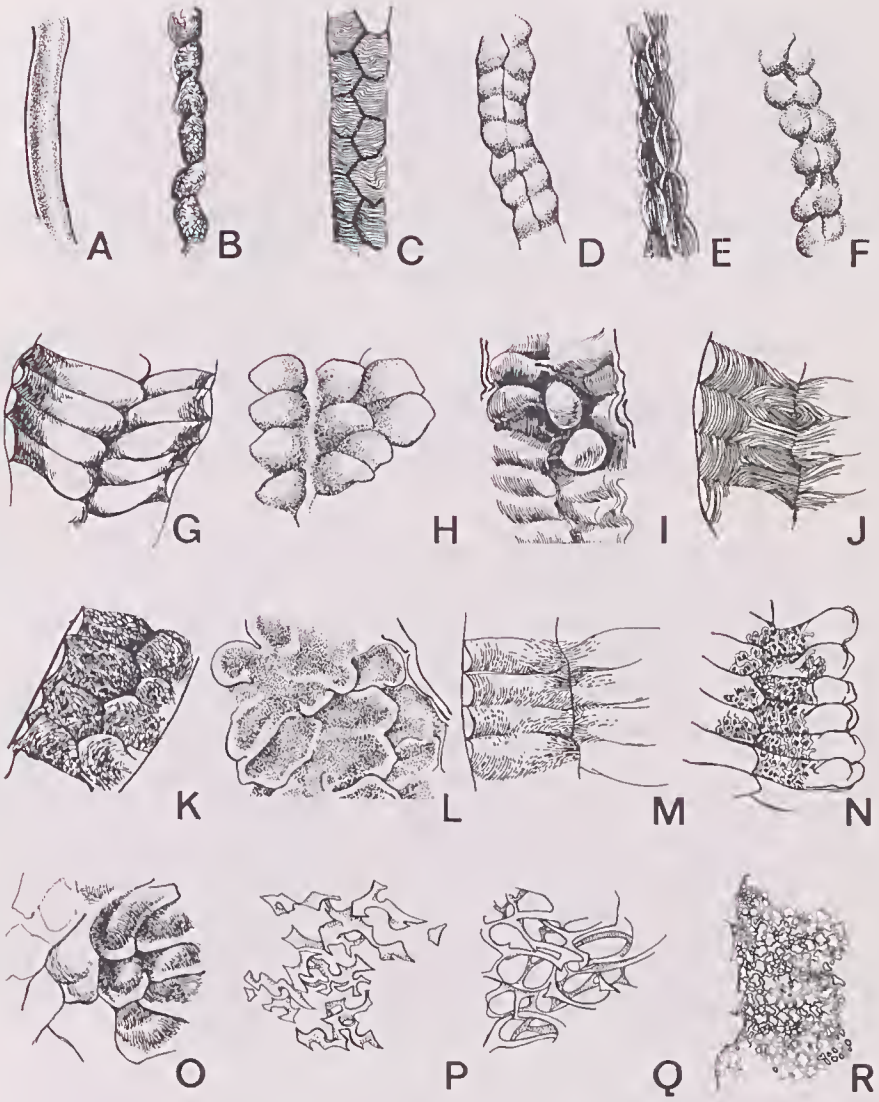

Fig. 3. Surfaee pattern eomponents of *Zieria* seeds. A. *Ridge units* indistinet, smooth-surfaeed. B–F. *Ridge units* distinet. B. Patterned-surface. C. Angular, strongly patterned. D. Oval, smooth-surfaced. E. Oval, ehained, with concave surface. F. Pear-shaped, chained, smooth-surfaeed. G–I. *Inter-ridge units*. G. Long-reetangular. H. Triangular. I. Oval to round. J–O. *Inter-ridge surface structure and unit surface texture*. J. Ribbed, strongly striate. K. Colliculate, finely seabrate. L. Undulate, smooth. M. Ribbed, weakly striate or fleeked. N. Ribbed, eoarsely scabrate. O. Collieulate, seabrate-striate. P–R. *Wax structure*. P. Flakes. Q. Crystals. R. Flocs.

Presence or absence of wax is readily observed and ean be considered as an important distinguishing attribute. In one case, however, (sample 37, pattern 18) thc wax is non-persistent, being found only at the immature stage, while in another, seeds with identical surface patterns may or may not havc wax (samplcs 80, 82, pattern 13). Differences in wax structure are usually clear, but in a few cases it is diffieult to distinguish between fine crystalline wax and wax flocs. It seems likely that the appearance of the wax may change somewhat with increasing maturity of the seed. The abundance of wax varies with the stage of maturity and henee this particular attribute is of limited comparative value.

(2) Sampling problems

Out of the 38 ridged seed surface patterns distinguished 11 are represented by a single sample only and a further 8 by two samples only (Tables 2–5). The study of further material (when available) could lead to an overlap in the range of variation in some cases, e.g. pattern 23 (Fig. 9E, F) with pattern 24 (Fig. 10G, H), 4 with 5 (Fig. 4G, H; Fig. 5A, B), and pattern 7 (Fig. 5E, F) with pattern 8 (Fig. 5G, H). In other cases the distinctiveness of the surface pattern suggests that overlap with other patterns is unlikely: within this category are patterns 1, 3, 10, 11, 15, 17, 27, 30, 31, 32, 33, 34, 35, 36 and 37 (Figs. 4, 7, 8, 10–13). The remaining 19 patterns are represented by 3–9 samples each and appear to be constant.

(3) Classification of patterns

The ridged surface patterns can be classified into 3 major groups and a number of subgroups on the basis of structural similarities (Tables 2–5)*. The degree to which these reflect relationship or parallel evolution is unknown at present since there is no information available about the effects of selection pressures upon seed surface structure.

Group I: Patterns 1–13 (Table 2, Figs. 4–7) form a group characterized by prominent, broad ridges which are clearly double and usually smooth-surfaced; wax is always present. Subgroup A (patterns 1–3, Fig. 4) show a strongly ribbed inter-ridge surface, subgroup B (patterns 4–9, Figs. 4–6) show some ribbing but also have flat areas present between the ridges, and subgroup C (patterns 10–13, Figs. 6–7) are usually flat between the ridges.

Group II: This group, comprising patterns 14–26 (Table 3, Figs. 7–10) is rather less coherent than Group I but in all cases the mature seeds lack wax. Most types within this group have long, prominent, crested ridges which are smooth-surfaced but rather narrow. Subgroup A (patterns 14–18, Figs. 7–8) has ridges 16–25 μm wide and a strongly ribbed inter-ridge surface except when cross-ridges are abundant; the inter-ridge surface then appears concave (pattern 18, Fig. 8C, D). Subgroup B (patterns 19–22, Figs. 8–9) has much narrower ridges (6–8 μm wide) which appear to be single in structure, and a ribbed or colliculate (pattern 22, Fig. 9C, D) inter-ridge surface. Subgroup C (patterns 23 and 24, Figs. 9C, D; E, F) is very similar to Subgroup B but cross-ridges are abundant and hence the inter-ridge surface appears concave, flat or undulate. The types in Subgroup D (patterns 25 and 26, Fig. 10A, B; C, D) lack cross-ridges and have a flat inter-ridge surface.

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* **Key to Attributes in Tables 2–5**

Ridge development: 1 = not prominent, 2 = prominent and crested, 3 = prominent and erect.

Ridges long = +, short = –

Ridges smooth = +, patterned = –

Ridges single = +, double = –

Ridges with many branches = +, with few branches = –

Ridge units distinct = +, indistinct = –

Cross-ridge frequency: 0 = absent, 1 = few, 2 = many.

Inter-ridge development pattern: 0 = absent, 1 = indistinct, 2 = distinct.

Inter-ridge pattern structure: 1 = long-rectangular units, 2 = rectangular units, 3 = short-rectangular units, 4 = triangular units, 5 = oval to round units, ( ) = uncommon.

Inter-ridge surface texture: 1 = ribbed, 2 = colliculate, 3 = undulate, 4 = flat, 5 = concave, 6 = rugose.

Unit surface texture: 1 = smooth, 2 = flecked (weakly striate), 3 = striate, 4 = finely scabrate, 5 = coarsely scabrate, 6 = rugose.

Wax development: 0 = absent, 1 = non-persistent, 2 = persistent.

Wax abundance: 1 = sparse, 2 = common, 3 = abundant.

Wax structure: 1 = crystals, 2 = compact floes, 3 = powdery floes, 4 = flakes.

TABLE 2

Seed surface structure of ridged *Zieria* seeds: Group I

Attribute*	Subgroup	A			B						C			
	Pattern No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Ridge development		2	2	2	3	3	3	3	3	3	3	3	3	3
,, spacing (μm)		60–105	60–85	35–45	35–55	50–120	30–60	45–90	50–75	42–60	30–50	50–85	40–65	50–70
,, width (μm)		25–30	25–30	21–24	16–20	18–28	18–28	18–20	24–30	24–30	14–20	21–27	15–21	15–24
Ridges long		+	+	+	+	+	+	−	−	+	+	−	+	+
,, smooth		+	+	+	+	+	+, −	+	+	+	+	+, −	+	+
,, single		−	−	−	−	−	−	−	−	−	−	−	−	−
,, with many branches		−	−	−	−	+	−	−	−	−	−	−	+	−
Ridge units distinct		+	+	+	+	+, −	+	−	+	+	+	+	−	+
,, unit length (μm)		21–28	18–20	15–18	12–16	15–20	14–18	15–20	18–24	18–21	21–24	18–21	18–21	20–24
,, ,, width (μm)		14–18	15–20	10–12	8–10	9–14	10–14	8–12	12–15	15–18	12–15	12–18	12–15	12–14
Cross-ridge frequency		0	1	1	0	2	1	0	0	1	1	0	1	1
Inter-ridge pattern development		2	2	2	0, 1	0, 2	2, 1	2	2	0,1	0, 2	0	1	2
,, structure		1, (5)	1	3	3	1, (5)	2, 3, (5)	1, 5	1, 5	2	2, 3, (5)	−	3, 5	3, 4, 5
Rectangular unit length (μm)		45–55	35–45	18–21	14–18	50–60	30–35	40–50	35–45	30–40	25–30	−	18–20	18–22
,, ,, width (μm)		25–30	15–25	12–15	12–18	10–14	14–17	18–22	18–21	18–24	15–20	−	20–22	16–20
Oval unit diameter (μm)		15–20	−	−	−	15–20	14	20–30	24–27	−	15–20	−	15–20	26–30
Triangular unit dimensions (μm)		−	−	−	−	−	−	−	−	−	−	−	−	18–20
Inter-ridge surface		1	1	1	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4	4	4	4	3, 4
Unit surface texture		5	1	1	1	1, 4	1	1	1	1	1	1	1	1
Wax development		2	2	2	2	2	2	2	2	2	2	2	2	0, 2
Wax abundance		2	1	2	1, 2	2, 3	2, 3	3	3	3	3	3	1	1
Wax structure		1	1	2	1, 3	(1), 3	1	3	1, (2)	1	1	1	1	3
Sample Numbers		63	58, 59, 60, 61, 62	33	29	30, 31, 32, 34, 35	12, 15, 16, 18, 19, 23, 24	64	65, 66, 67, 70, 71, 72, 73, 74, 75	20, 21, 22	17	68, 69	25, 26, 27	77, 78, 80, 81, 82

* For key to attributes see p. 92

TABLE 3

Seed surface structure of ridged *Zieria* seeds: Group II

Attribute*	Subgroup	A					B				C		D	
	Pattern No.	14	15	16	17	18	19	20	21	22	23	24	25	26
Ridge development		2	2	2	2	3	2	2	1	1	2	2	2	3
,, spacing (μm)		50–70	60–80	35–45	30–60	50–80	60–80	50–70	24–45	40–60	50–70	60–90	60–100	30–50
,, width (μm)		18–24	16–18	18–22	16–25	18–25	8–10	6–7	9–10	6–7	12–15	8–10	7–14	6–7
Ridges long		+	+	+	+	+	+	+	–	+	+	+	+	–
,, smooth		+	+, –	+	+, –	+, –	+	+	+	+	+	+	+	+
,, single		–	–	–	–	–	+	+	+	+	+	+	+	+
,, with many branches		–	–	–	–	–	–	–	+	–	+	+	–	–
Ridge units distinct		+	–	+, –	+, –	+	+	+	+	–	+	–	–	–
,, unit length (μm)		15–18	–	12–18	14–18	16–28	15–18	16–20	12–16	–	20–28	16–24	–	–
,, ,, width (μm)		9–12	–	10–12	10–12	10–12	8–10	6–7	8–12	–	12–15	8–10	–	–
Cross-ridge frequency		1	1	1	2	2	1	1	1	1	2	2	0	0
Inter-ridge pattern development		2	2	2	2	1	2	2	2	2	2	1	1	1
,, structure		1, (5)	1, (5)	2, 5	3, 5	2, 4, 5	1, (5)	1, (5)	2, 5	4, 5	2, (5)	1	1	2, 5
Rectangular unit length (μm)		45	45	21–30	20	30–40	36–40	40	31	–	30–35	35–45	40	18–24
,, ,, width (μm)		15	15	12–15	13	15–22	15–18	16	15	–	18–20	18–20	12	12–14
Oval unit diameter (μm)		20	20	18–20	18–20	20–22	20–25	16–20	20	17–20	24	–	–	18–21
Triangular unit dimension (μm)		–	–	–	–	20–22	–	–	–	17–20	–	–	–	–
Inter-ridge surface		1	1	1	1	1, 4, 5	1	1	1	2	(3), 4, 5	3, 4, 5	4	4
Unit surface texture		3	3, 2	3	2	1, 2	3	3	5	1	2	1, 2	1, 2	1
Wax development		0	0	1	0	1	0	0	0	0	0	0	0	0
Wax abundance		–	–	1	–	1	–	–	–	–	–	–	–	–
Wax structure		–	–	3	–	3	–	–	–	–	–	–	–	–
Sample Numbers		9, 10, 11	56, 57	41, 42, 43, 44	45, 46	36, 37, 38, 39, 40	1, 2, 3, 4, 5, 7, 8	50, 51, 52	47, 48, 49	93, 94, 97, 99, 102, 104	6	100, 101	111, 112, 113	98, 103 105

* For key to attributes see p. 92.

Group III: Patterns 27–30 (Table 4, Figs 10–11) form a group characterized by an undulate inter-ridge surface which is made up of 2–5 sets of predominantly triangular, oval or round units. Wax is usually absent.

TABLE 4

Seed surface structure of ridged *Zieria* seeds: Group III

Attribute*	Pattern No. 27	28	29	30
Ridge development	2	1	3	1
,, spacing (μm)	40–70	70–90	40–60	25–75
,, width (μm)	10–14	10–14	6–7	6–7
Ridges long	+	–	+	+
,, smooth	+	+	+	+
,, single	+	+	+	+
,, with many branches	–	+	+	+
Ridge units distinct	+	–	+, –	–
,, unit length (μm)	14–18	–	12–14	–
,, ,, width	10–14	–	6–7	–
Cross-ridge frequency	0	2	2	1
Inter-ridge pattern development	2	1	1	2
,, ,, structure	2, 4, 5	5	3, 5	4, 5
Rectangular unit length (μm)	30	–	16	–
,, ,, width (μm)	12	–	14	–
Oval unit diameter (μm)	15–20	20–30	15	21–24
Triangular unit dimension (μm)	14–18	–	–	12–18
Inter-ridge surface	3	3	3	3
Unit surface texture	4	1, 2	1, 2	1, 2
Wax development	0	0	0	0, 2
Wax abundance	–	–	–	1
Wax structure	–	–	–	3
Sample Numbers	95, 96	106, 107, 108	53, 54, 55	76, 79

* For key to attributes see p. 92.

Patterns 31–38 (Table 5, Figs 11–13) appear to be very distinct; they cannot be readily assigned to any of the groups described above.

Non-ridged surface patterns

Two of the 40 patterns are unridged. Pattern 39 (Fig. 13E, F) is colliculate with parallel rows of rectangular units (30–38 x 15–20 μm) and oval units (22–24 μm across) giving a ribbed appearance; the surface texture of the units is coarsely scabrate-striate. Pattern 40 is tuberculate; the tubercles are c. 20 μm high, 18–25 μm in diameter and smooth-surfaced with areas between the tubercles also smooth below crystalline wax.

The colliculate-ribbed pattern is unique in *Zieria* and has not yet been found in other genera of the tribe Boronieae (40 samples in 15 genera, Powell unpublished data).

Tuberculate patterns are found in some other members of the tribe Boronieae, for example, in *Boronia coerulescens*, *B. ledifolia* and *Geleznowia verrucosa* (Powell, unpublished data).

Taxonomic significance of seed morphology

In order to assess the taxonomic significance of seed-morphology in this genus, the seed surface data are compared in Table 6 with the taxa defined by Armstrong (unpubl.).

TABLE 5

Seed surface structure of ridged *Zieria* seeds: very distinct patterns

Attribute* \ Pattern No.	31	32	33	34	35	36	37	38
Ridge development ..	1	1	3	1	1	2	2	3
„ spacing (μm) ..	55–80	25–40	18–20	40–60	45–60	40–50	20–26	23–35
„ width (μm)	12–14	9–12	15–20	10–17	10–12	7–14	15–18	20–30
Ridges long	–	–	+	+	+	+	+	+
Ridges smooth	+	–	+	–	+	+	+	–
„ single	+	+	–	+	+	+	+	–
„ with many branches	+	+	+	+	–	–	–	–
Ridge units distinct ..	–	–	+	+	–	–	+	+
„ unit length (μm) ..	–	–	12–15	16–20	–	–	10–12	14–17
„ „ width (μm) ..	–	–	7–9	10–17	–	–	14–18	11–14
Cross-ridge frequency ..	1	0	2	1	0	1	0	1
Inter-ridge pattern development ..	1	1	1	2	2	2	1	1
„ structure ..	1, 4	2, 4	2	2, 4, 5	3, 5	3	3, 4	3
Rectangular unit length (μm)	35–45	25–30	10–12	25	20–25	20	20–24	25
„ „ width (μm)	16–24	12–15	8–10	16	18–20	16–20	10–12	21
Oval unit diameter (μm) ..	–	–	–	20	12–15	–	–	–
Triangular unit dimensions (μm)	20	20–25	–	20–22	–	–	12–16	–
Inter-ridge surface.. ..	3, 4	3	3, 4	2	2	3	6	1
Unit surface texture ..	1	6	2	4	4	1	1	1
Wax development ..	0	0	0	0	2	2	2	2
Wax abundance ..	–	–	–	–	3	1, 2	1	3
Wax structure	–	–	–	–	4	2	2	1
Sample Numbers	110	119	92	83, 84	85	13, 14	28	114, 115, 116, 117, 118

* For key to attributes see p. 92.

TABLE 6

Zieria taxa compared with seed patterns and groups

Taxon	Seed pattern		Seed sample numbers
	Group	Number	
Z. arborescens ssp. "*a*" ..	II B	19	1, 2, 3, 4, 5, 7, 8
	II C	23	6
Z. aspalathoides ssp. "*a*" ..	I B	6	12, 15, 16, 18, 19
	**	36	13, 14
	I C	10	17
ssp. "*b*" ..	I B	9	20, 21, 22
ssp. "*c*" ..	I B	6	23, 24
Z. chevalieri	I B	4	29
Z. cytisoides ssp. "*a*" ..	II A	18	36, 37, 38, 39, 40
ssp. "*b*" ..	II A	16	41, 42, 43, 44
Z. fraseri ssp. "*a*" ..	I A	1	63
ssp. "*b*" ..	I B	5	30, 31, 32, 34, 35
	I A	3	33

TABLE 6—*continued*

Taxon	Seed pattern		Seed sample numbers
	Group	Number	
Z. furfuracea ssp. "*a*" ..	II A	17	45, 46
ssp. "*b*" ..	II B	21	47, 48, 49
Z. granulata	II B	20	50, 51, 52
Z. involucrata	II A	15	56, 57
Z. laevigata ssp. "*a*" ..	I A	2	58, 59, 60, 61, 62
ssp. "*b*" ..	I B	8	65, 66, 67, 70, 71, 72, 73, 74, 75
	I C	11	68, 69
Z. minutiflora ssp. "*a*" ..	I C	13	77, 78, 80, 81
	III	30	76, 79
ssp. "*b*" ..	I C	13	82
Z. murphyi	**	34	83, 84
Z. obcordata ssp. "*a*" ..	**	35	85
Z. pilosa	**	40	86, 87, 88, 89, 90, 91
Z. robusta	**	33	92
Z. smithii ssp. "*a*" ..	II B	22	93, 94, 97, 99, 102, 104
	II C	24	100, 101
	II D	26	98, 103
	III	27	95, 96
ssp. "*b*"	III	28	106, 107, 108
	II D	26	105
	**	39	109
Z. sp. nov. '*A*'	I C	12	25, 26, 27
Z. sp. nov. '*B*'	**	37	28
Z. sp. nov. '*C*'	III	29	53, 54, 55
Z. sp. nov. '*D*'	I B	7	64
Z. sp. nov. '*E*' ssp. "*a*" ..	**	31	110
ssp. "*b*" ..	II D	25	111
ssp. "*c*" ..	II D	25	112, 113
Z. sp. nov. '*F*'	II A	14	9, 10, 11
Z. sp. nov. '*G*'	**	32	119
Z. veronicea	**	38	114, 115, 116, 117, 118

** Very distinct pattern (see Table 5).

In general, seed surface morphology is taxonomically useful. Amongst the better-sampled taxa the surface pattern is constant within *Z. aspalathoides* ssp. '*b*', *Z. cytisoides* ssp. '*a*' and ssp. '*b*', *Z. furfuracea* ssp. '*b*', *Z. granulata*, *Z. laevigata* ssp. '*a*', *Z. pilosa*, *Z.* sp. nov. '*A*', *Z.* sp. nov. '*C*', *Z.* sp. nov. '*F*' and *Z. veronicea*. Amongst the less well-sampled taxa the surface pattern of *Z. fraseri* ssp. '*a*', *Z. furfuracea* ssp. '*a*', *Z. involucrata*, *Z. murphyi*, *Z. obcordata* ssp. '*a*', *Z. robusta*, *Z.* sp. nov. '*B*', *Z.* sp. nov. '*E*' ssp. '*a*' and *Z.* sp. nov. '*G*' is distinct and seems likely to remain constant with further sampling.

In *Z. chevalieri* and *Z.* sp. nov. '*D*' the distinctiveness of the pattern may be lost with further sampling, falling within the range of variation shown in *Z. fraseri* ssp. '*b*' and *Z. laevigata* ssp. '*b*' respectively, and in the case of *Z. minutiflora* ssp. '*b*', *Z. aspalathoides* ssp. '*c*' and *Z.* sp. nov. '*E*' ssp. '*b*' the surface pattern is shared with other taxa of each species.

In 7 taxa (Table 6) more than one seed-type per taxon occurs: *Z. arborescens* ssp. '*a*', *Z. minutiflora* ssp. '*a*', *Z. fraseri* ssp. '*b*' and *Z. laevigata* ssp. '*b*' each have two types of pattern, *Z. aspalathoides* ssp. '*a*' and *Z. smithii* ssp. '*b*' have three types and *Z. smithii* ssp. '*a*' has four types. In such cases seed surface morphology does not correlate well with the taxonomy. Considering these taxa and their surface patterns in more detail:

(1) *Z. arborescens*: Two seed surface patterns are present within ssp. '*a*' (Table 6; Figs. 8E, F; 9E, F). Pattern 19 is predominant, being found in 7 out of 8 samples. It differs from 23 in the frequency of branches and cross-ridges, in ridge unit dimensions, in inter-ridge surface pattern and somewhat in width and spacing of ridges and the dimensions of the inter-ridge units.

The patterns are not very similar. The predominance of 19 suggests that it is the characteristic pattern of *Z. arborescens* ssp. '*a*' and 23 can be considered as a relatively rare deviant. Pattern 19 is similar to pattern 20 (found in *Z. granulata*) and 21 (*Z. furfuracea* ssp. '*b*') whilst pattern 23 is structurally very similar to 24 (found in *Z. smithii* ssp. '*a*').

(2) *Z. aspalathoides*: Four seed surface patterns are present (Table 6; Figs. 5C, D; 6A, B; C, D; 12G, H). Pattern 6 is the commonest being found in 7 out of 13 samples. All four patterns have long ridges, smooth-surfaced ridges and inter-ridge units, and persistent wax. Pattern 36 differs from all others in having narrow ridges and an undulate inter-ridge surface. Patterns 6, 9 and 10 are similar, differing one from another only to a small extent in width of ridges and distinctness and structure of the inter-ridge pattern.

The seed data support the taxonomic recognition of ssp. '*b*' since seed pattern 9 is restricted to this taxon, but do not reflect the taxonomic recognition of ssp. '*c*' since pattern 6 is present also in ssp. '*a*'. The distinctiveness of pattern 36 suggests that ssp. '*a*' is heterogeneous but this is not indicated by other morphological data.

(3) *Z. fraseri*: Three seed surface patterns (1, 3, and 5) are present (Table 6; Figs. 4A, B; E, F; 5A, B). All have long, relatively broad, smooth-surfaced double ridges, a ribbed inter-ridge surface and persistent wax. They differ, one from another, in the frequency of cross-ridges, the dimensions of the inter-ridge units, in wax structure and somewhat in the spacing of ridges, in ridge unit dimensions, in frequency of branches and in surface texture of inter-ridge units.

The seed surface data reflect the taxonomic recognition of *Z. fraseri* ssp. '*a*' but suggest that *Z. fraseri* ssp. '*b*' is heterogeneous for this character. Pattern 5, the predominant pattern of this subspecies, resembles more closely patterns 4 (found in the New Caledonia species, *Z. chevalieri*) and 6 (found in *Z. aspalathoides* ssp. '*a*' and ssp. '*c*') than pattern 3.

(4) *Z. laevigata*: Three seed surface patterns (2, 8, and 11) are present (Table 6; Figs. 4C, D; 5G, H; 6E, F). The patterns are similar in having double, generally smooth-surfaced ridges with few branches, distinct ridge units, smooth inter-ridge units and persistent wax. Both pattern 8 and 11 differ from 2 in ridge development, ridge length, cross-ridge frequency and abundance of wax; from each other they differ in inter-ridge pattern structure.

The seed data and taxonomy are very strongly correlated in *Z. laevigata* ssp. '*a*' since seed pattern 2 (well represented by 5 seed samples) is restricted to this taxon. *Z. laevigata* ssp. '*b*', on the other hand, is heterogeneous in seed surface morphology,

comprising patterns 8 and 11. Pattern 8 is predominant; pattern 11 may be considered as a less eommon deviant, the inter-ridge structure being undeveloped in this case.

The close taxonomic relationship between ssp. '*a*' and ssp. '*b*' is not apparent from the seed data. Pattern 2 more closely resembles 3 (*Z. fraseri* ssp. '*b*') whereas patterns 8 and 11 are more similar to 7 (*Z.* sp. nov. '*D*').

(5) *Z. minutiflora*: Two seed surface patterns (13, 30) are present (Table 6; Figs. 7A, B; 12A, B). Both types have long, smooth ridges with few eross-ridges, a distinet inter-ridge pattern comprising mainly oval and triangular-shaped units and an undulate inter-ridge surface. Pattern 13 is predominant being present in 5 of the 7 seed samples studied. It is quite distinet from pattern 30 in having broad, double ridges which are prominent and ereet, distinct ridge units and inter-ridge units of different dimensions.

There is no agreement between the seed data and the taxonomic data for this species. Seed pattern 13 is present in both subspeeies and the concurrence of patterns 13 and 30 within ssp. '*a*' indicate it is heterogeneous for this character.

(6) *Z. smithii*: Six seed surface patterns are present (Table 6; Figs. 9C, D; 9G, H; 10 C–H; 13E, F). Pattern 22 is eommon, being found in 6 of the 17 speeimens sampled in this taxon. Patterns 26 and 28 are each found in three samples, 24 and 27 in two samples and 39 is reeorded from a single sample. All types have single, smooth-surfaced ridges and lack wax. In some cases the ridges are narrow or very narrow but relatively widely-spaced across the seed, and ridge units are indistinct. The types differ in almost every other attribute: ridges may be long or short, braneh es and cross-ridges few or many, the inter-ridge pattern distinet or indistinct. Pattern units differ as do inter-ridge surfaces and unit surface texture.

The seed data do not coincide at all with the taxonomie data: in both subspecies seed morphology is heterogeneous. In ssp. '*a*' there are 4 seed surface patterns. Patterns 22, 24 and 26 all fall within Group II seed type but are not closely associated: 22 (subgroup B) shows some similarity to 19, 20, and 21 (found in *Z. arborescens* ssp. '*a*', *Z. granulata* and *Z. furfuracea* ssp. '*b*' respeetively) while patterns 24 (subgroup C) and 26 (subgroup D) resemble more closely patterns 23 and 25, found in *Z. arborescens* ssp. '*a*' and *Z.* sp. nov. '*E*' ssp. '*b*' and '*c*' respectively. Pattern 27 is in Group III seed type and is loosely associated there with patterns 28, 29 and 30, found in *Z. smithii* ssp. '*b*', *Z.* sp. nov. '*C*' and *Z. minutiflora* ssp. '*a*' respectively.

In ssp. '*b*' three surface patterns occur. One of these (26) is recorded already in ssp. '*a*' and another (39) is very distinct, being non-ridged in structure. The third pattern (28) predominates, being found in 3 out of 5 samples; it resembles more closely pattern 29 (*Z.* sp. nov. '*C*') than others recorded in *Z. smithii*.

The taxonomic recognition of the two *Z. smithii* subspecies is not reflected by the extremely diverse seed surface patterns. Although *Z. smithii* has an extensive distribution pattern (Atherton, N. Queensland to E. Gippsland, Victoria) there is no correspondence between seed pattern variation and phytogeography.

Sourees of Variation

Sinee almost all of the material used came from herbarium sheets it seems likely that some of the variation present in well-sampled taxa (e.g. *Z. laevigata*, *Z. smithii*) could be related to differential treatment (drying and storing) following field eollection, and some to the maturity of the seeds studied. Although all samples selected were assigned to either mature (dark coloured, plump seeds) or immature (lighter coloured, flat seeds), the aetual maturity of the former group may have varied: the genus has an explosive seed dispersal mechanism and hence any apparently mature seeds remaining inside capsules on herbarium sheets may, in fact, be somewhat immature.

Developmental studies of material grown under controlled conditions may help also to explain some of the variation; they would give information on internal as well as surface structure and provide a better base for discussion of intra-specific variation and relationships.

Newell and Hymowitz (1978) have recently studied seed coat variation in *Glycine* subgenus *Glycine* using fresh seed from greenhouse grown plants. They examined 4–20 seeds per accession and a number of accessions per species. They found that there was very little variability within accessions but the variation was often considerable between accessions within species.

Relationships of Taxa

It has been possible to establish certain groups of seed surface patterns on the basis of structural similarities (Tables 2–5) and these are listed in Table 6 alongside the taxonomic entities.

In some cases the close relationship of taxa indicated morphologically is supported by the seed surface data, for example, general morphology suggests a close relationship between *Z. chevalieri*, *Z. fraseri*, *Z. laevigata* and Z. sp. nov. '*D*', and this relationship is supported by the seed surface data (seed pattern 4 (*Z. chevalieri*) is similar to pattern 5 (*Z. fraseri*); patterns 1 and 3 (*Z. fraseri*) are similar to pattern 2 (*Z. laevigata*) whilst pattern 8 (*Z. laevigata*) is very similar to pattern 7 (Z. sp. nov. '*D*')). Seed surface data coincides with the general morphological similarities between *Z. aspalathoides* (pattern 10), Z. sp. nov. '*A*' (pattern 12) and *Z. minutiflora* (pattern 13) and this concurrence is also seen in the three closely related species *Z. arborescens* (patterns 21 and 26), *Z. smithii* (patterns 24, 27 and 29) and Z. sp. nov. '*E*' (pattern 28). Again, the close relationship between *Z. cytisoides*, *Z. involucrata*, and Z. sp. nov. '*F*' indicated by general morphology, is supported by the seed surface data: seed pattern 18 (*Z. involucrata*) is similar to 19 (*Z. cytisoides*) and pattern 17 (Z. sp. nov. '*F*') is similar to both these patterns.

In other cases possible relationships indicated by the seed surface data are not correlated with general morphological data, for example: *Z. arborescens* (pattern 19) is not morphologically similar to either *Z. granulata* (pattern 20) or to *Z. furfuracea* ssp. '*b*' (pattern 21), *Z. furfuracea* ssp. '*a*' (pattern 17) is not similar to *Z. cytisoides* (patterns 16, 18) or to *Z. involucrata* (pattern 15); *Z. laevigata* (pattern 11) does not resemble closely either *Z. minutiflora* (pattern 13) or Z. sp. nov. '*A*' (pattern 12), and *Z. smithii* (patterns 27, 28) is not morphologically similar to either Z. sp. nov. '*C*' (pattern 29) or to *Z. minutiflora* (pattern 13). In these cases similarity in seed surface structure may be explained in terms of parallel evolution.

CONCLUSIONS

The detailed survey of seed surface patterns in *Zieria* indicates that there is a wide range of seed-morphological variation in the genus. While there is considerable coincidence between the seed data and the taxonomic entities recognized on other grounds, it is by no means universal. Hence seed morphology is of use for distinguishing taxa in only some instances within this genus. Also, as a basis for indicating phylogenetic relationship the seed data appear to be helpful occasionally in *Zieria* but conclusions must, in general, be based on other data. These findings contrast with many other studies where seed surface data have provided a strong base for delimitation of taxonomic entities and for phylogenetic conclusions.

Many earlier SEM studies have made use of only a single sample of seeds per taxon and hence some of the exact correlations between surface structure and taxonomic entities which have been reported may be more apparent than real. The present study indicates the necessity of sampling a taxon as widely as possible so that the amount of variation present both within and between taxa can be elucidated.

In *Zieria*, it may be concluded that for those taxa with diverse seed structure, evolution in seed surface patterns may be proceeding at a relatively rapid rate compared with other morphological features.

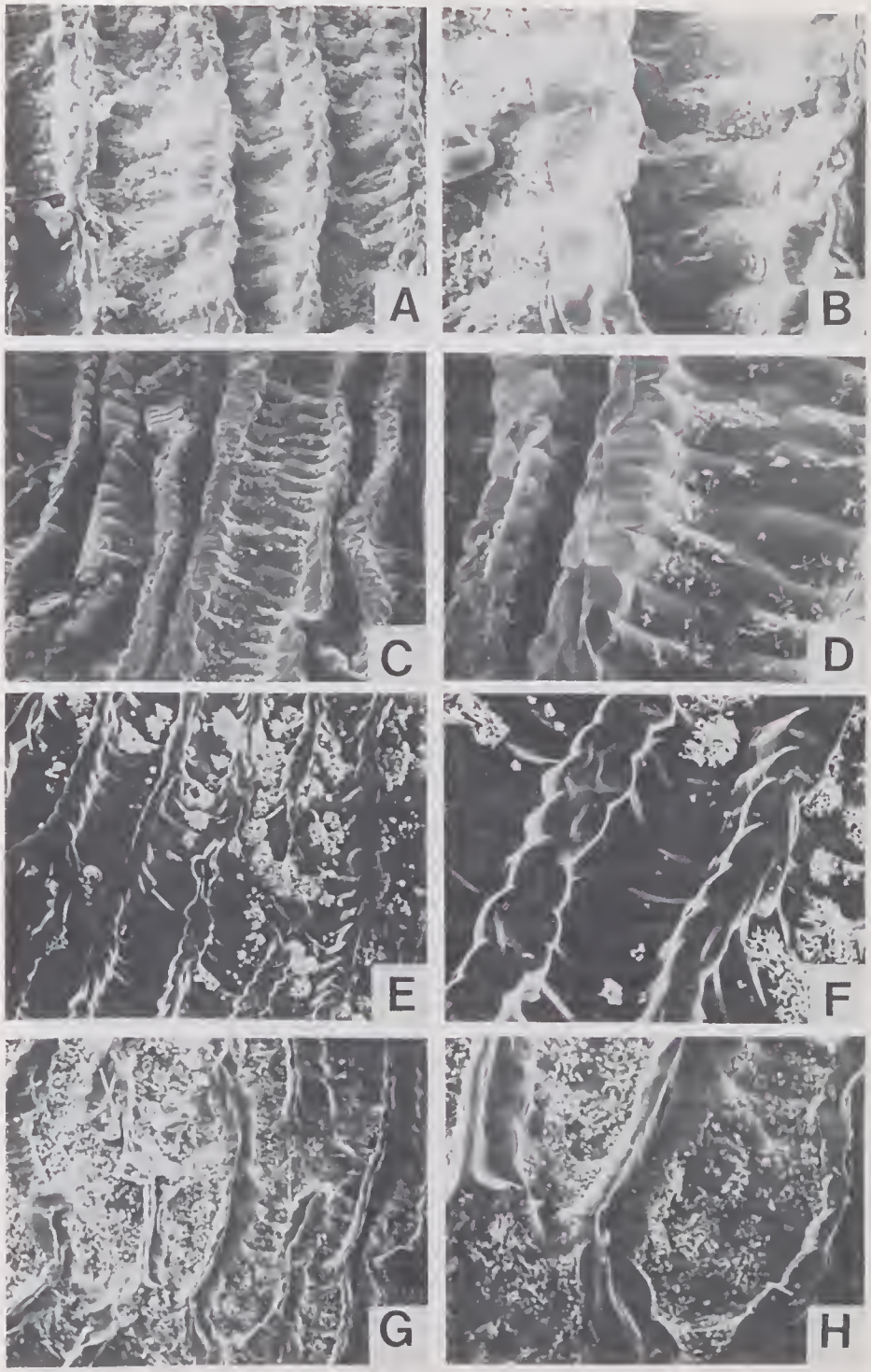

Fig. 4. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H, x 600. Sample numbers in brackets. A, B; **Pattern 1:** *Z. fraseri* ssp. '*a*' (63). C, D; **Pattern 2:** *Z. laevigata* ssp. '*a*' (61). E, F; **Pattern 3:** *Z. fraseri* ssp. '*b*' (33). G, H; **Pattern 4:** *Z. chevalieri* (29).

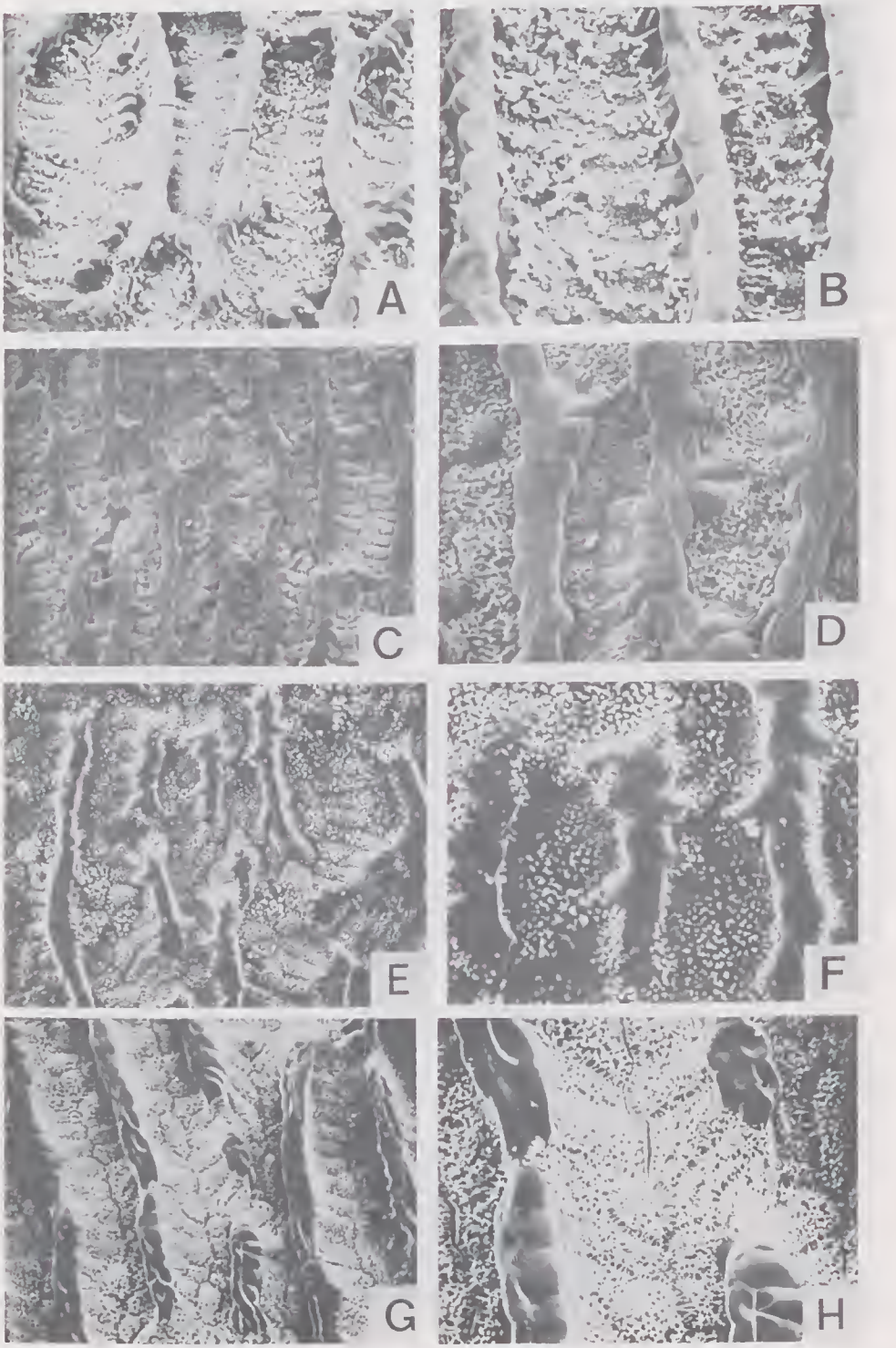

Fig. 5. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 5:** *Z. fraseri* ssp. '*b*' (35). C, D; **Pattern 6:** *Z. aspalathoides* ssp. '*a*' (16). E, F; **Pattern 7:** *Z.* sp. nov. '*D*' (64). G, H; **Pattern 8:** *Z. laevigata* ssp. '*b*' (73).

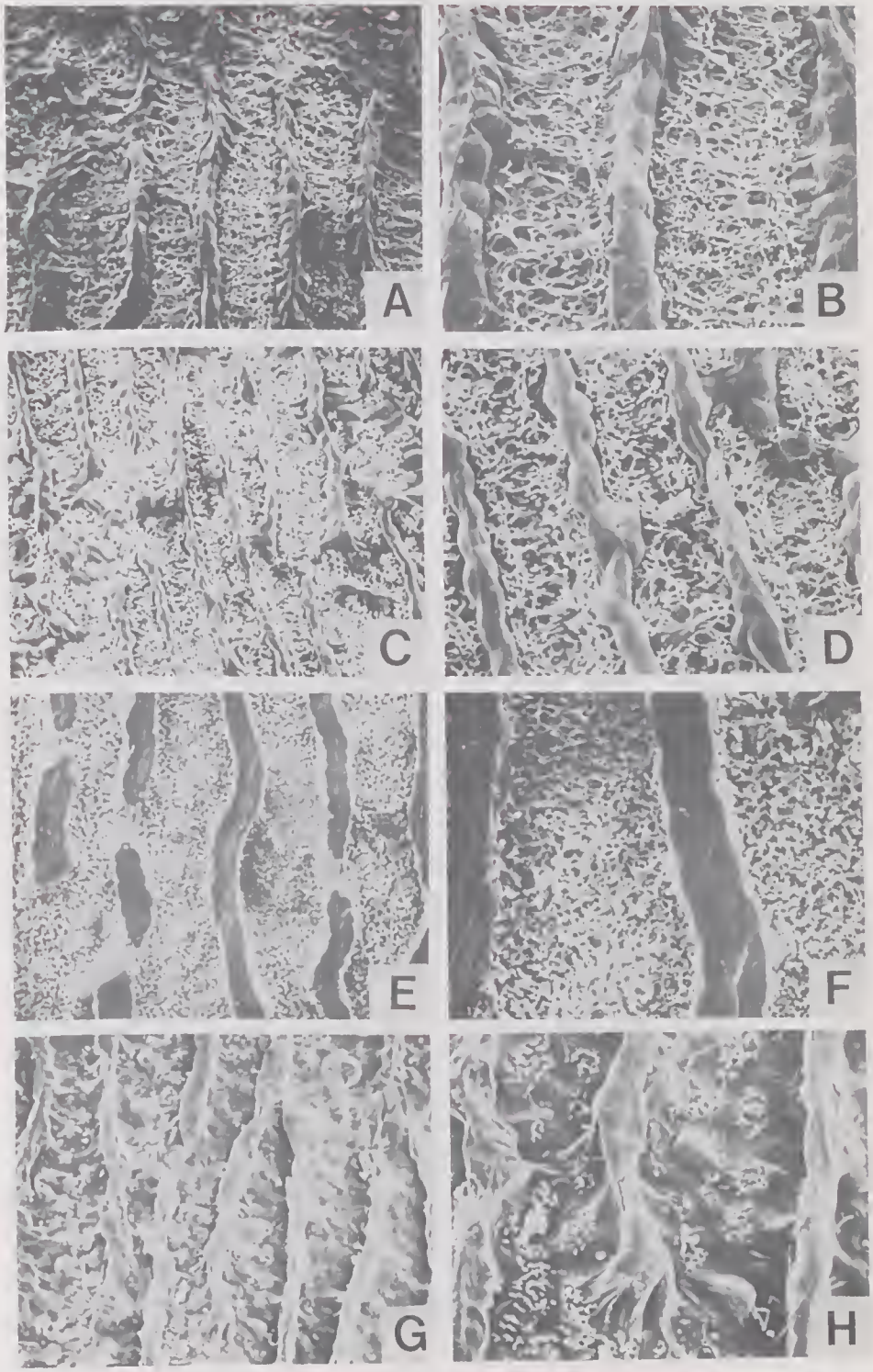

Fig. 6. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 9:** *Z. aspalathoides* ssp. '*b*' (21). C, D; **Pattern 10:** *Z. aspalathoides* ssp. '*a*' (17). E, F; **Pattern 11:** *Z. laevigata* ssp. '*b*' (68). G, H; **Pattern 12:** *Z.* sp. nov. '*A*' (26).

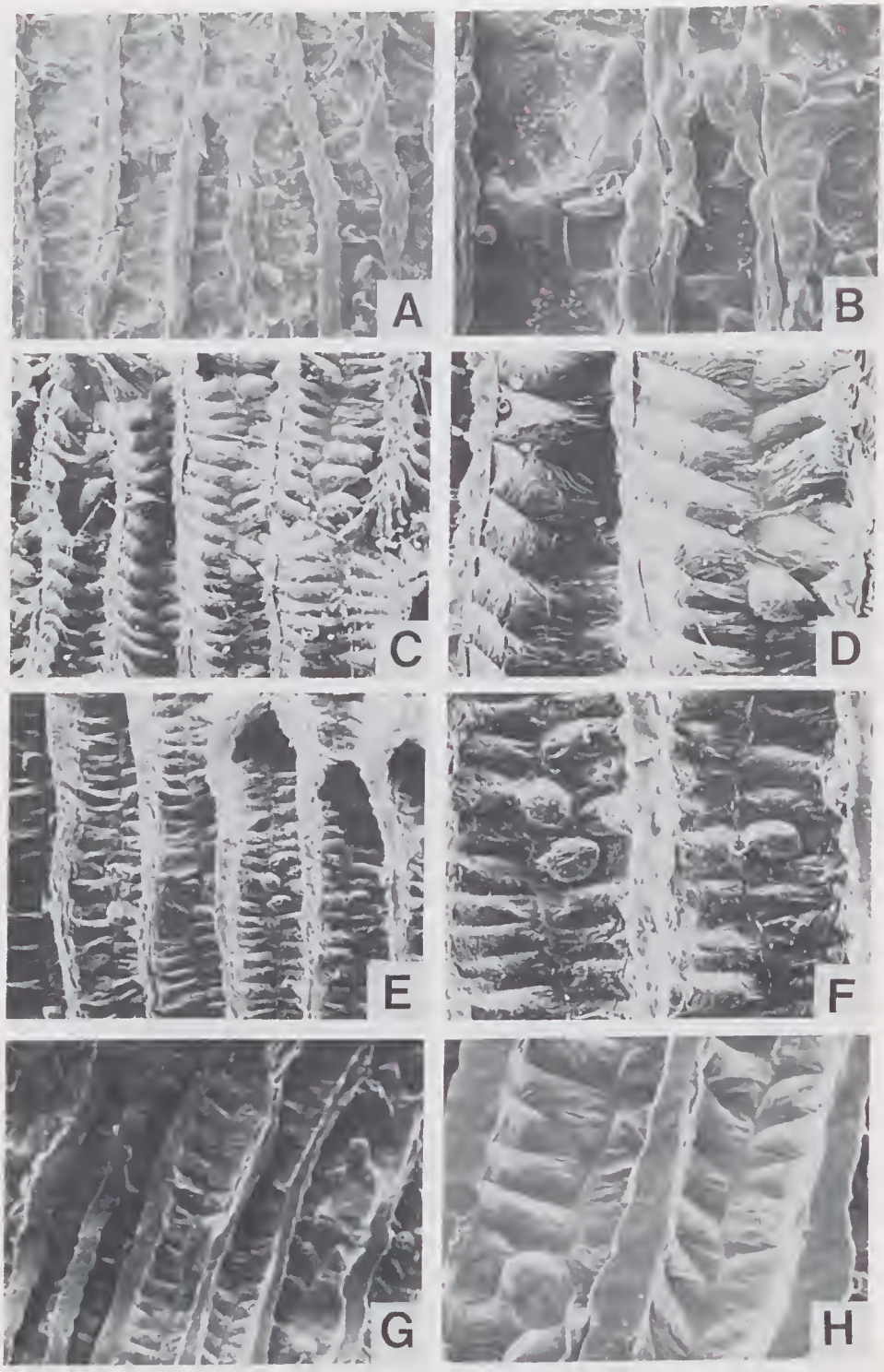

Fig. 7. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 13:** *Z. minutiflora* ssp. '*b*' (82). C, D; **Pattern 14:** *Z.* sp. nov. '*F*' (9). E, F; **Pattern 15:** *Z. involucrata* (56). G, H; **Pattern 16:** *Z. cytisoides* ssp. '*b*' (43).

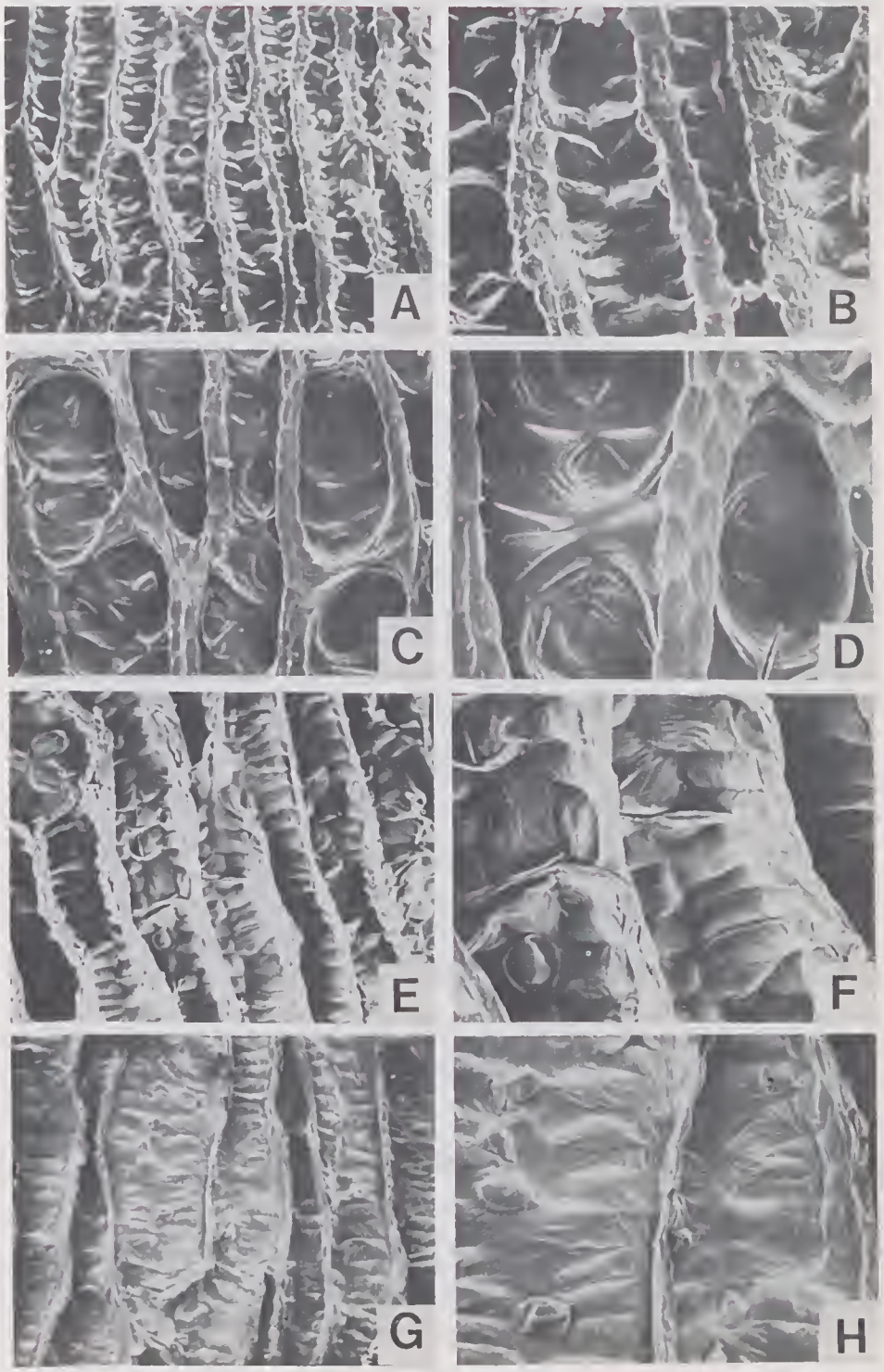

Fig. 8. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 17:** *Z. furfuracea* ssp. '*a*' (46). C, D; **Pattern 18:** *Z. cytisoides* ssp. '*a*' (37). E, F; **Pattern 19:** *Z. arborescens* ssp. '*a*' (3). G, H; **Pattern 20:** *Z. granulata* (51).

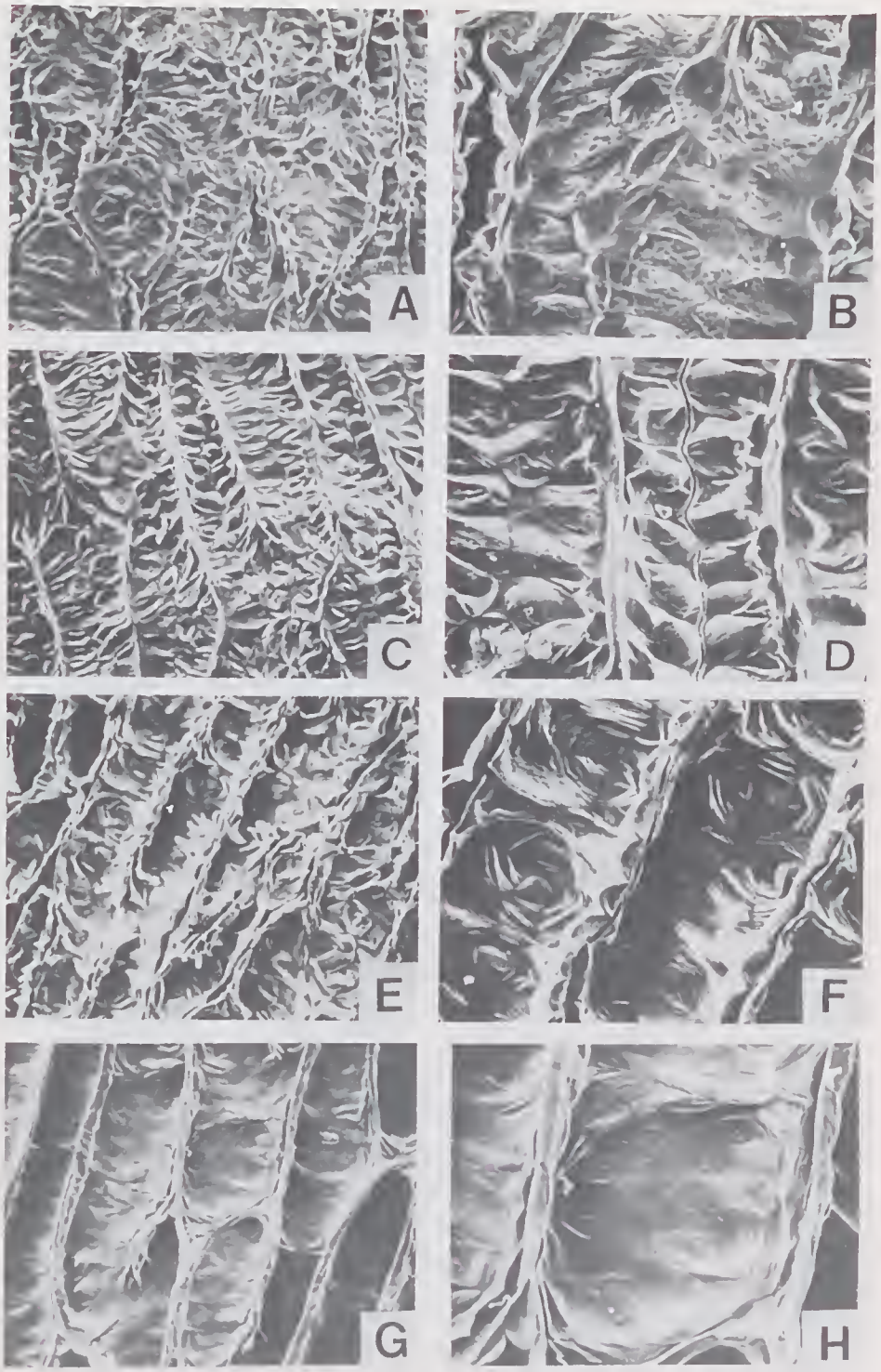

Fig. 9. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 21:** *Z. furfuracea* spp. '*b*' (49). C, D; **Pattern 22:** *Z. smithii* ssp. '*a*' (102). E, F; **Pattern 23:** *Z. arborescens* ssp. '*a*' (6). G, H; **Pattern 24:** *Z. smithii* ssp. '*a*' (100).

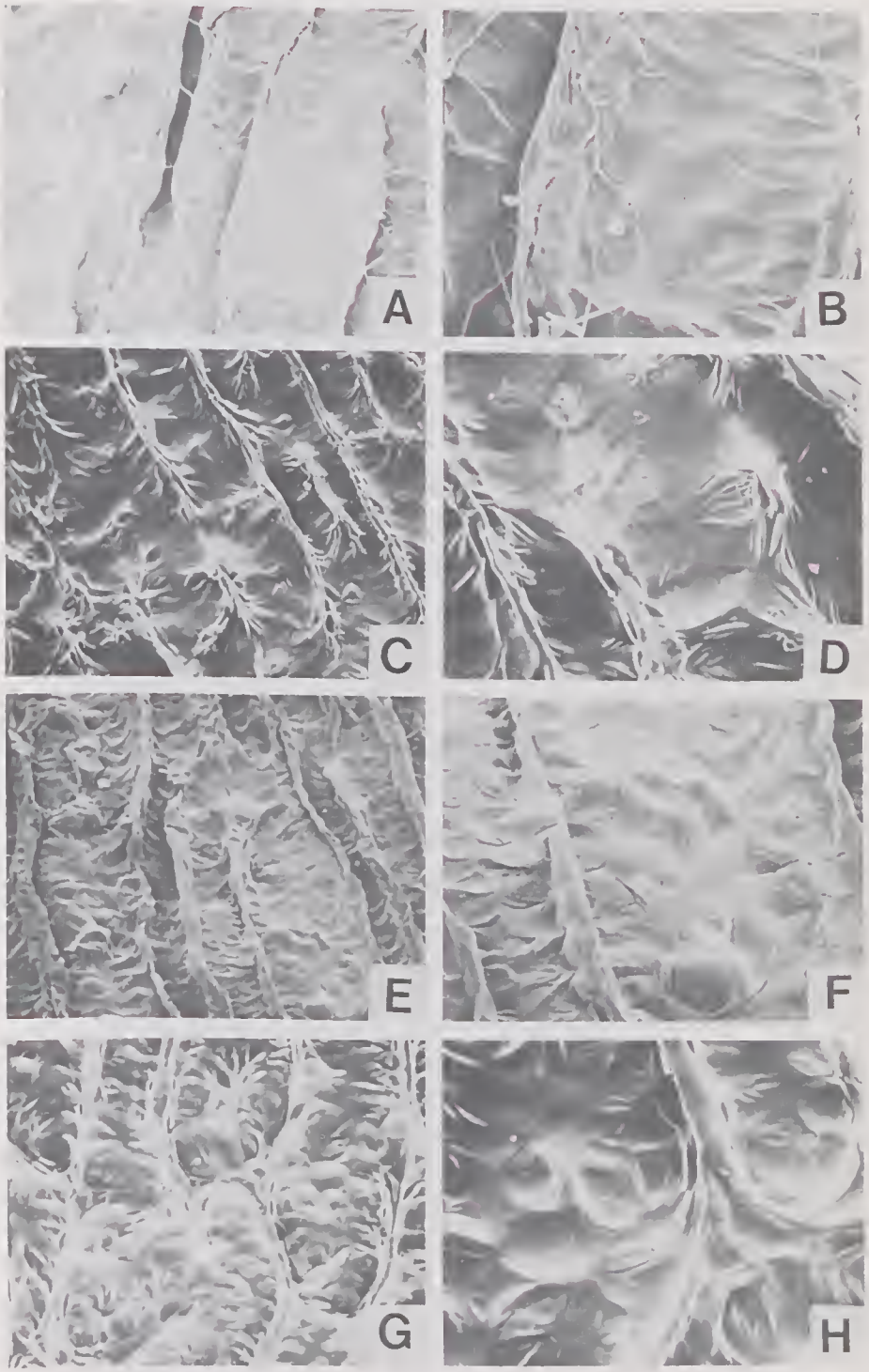

Fig. 10. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 25:** *Z.* sp. nov. '*E*' ssp. '*b*' (111). C, D; **Pattern 26:** *Z. smithii* ssp. '*a*' (103). E, F; **Pattern 27:** *Z. smithii* ssp. '*a*' (95). G, H; **Pattern 28:** *Z. smithii* ssp. '*b*' (106).

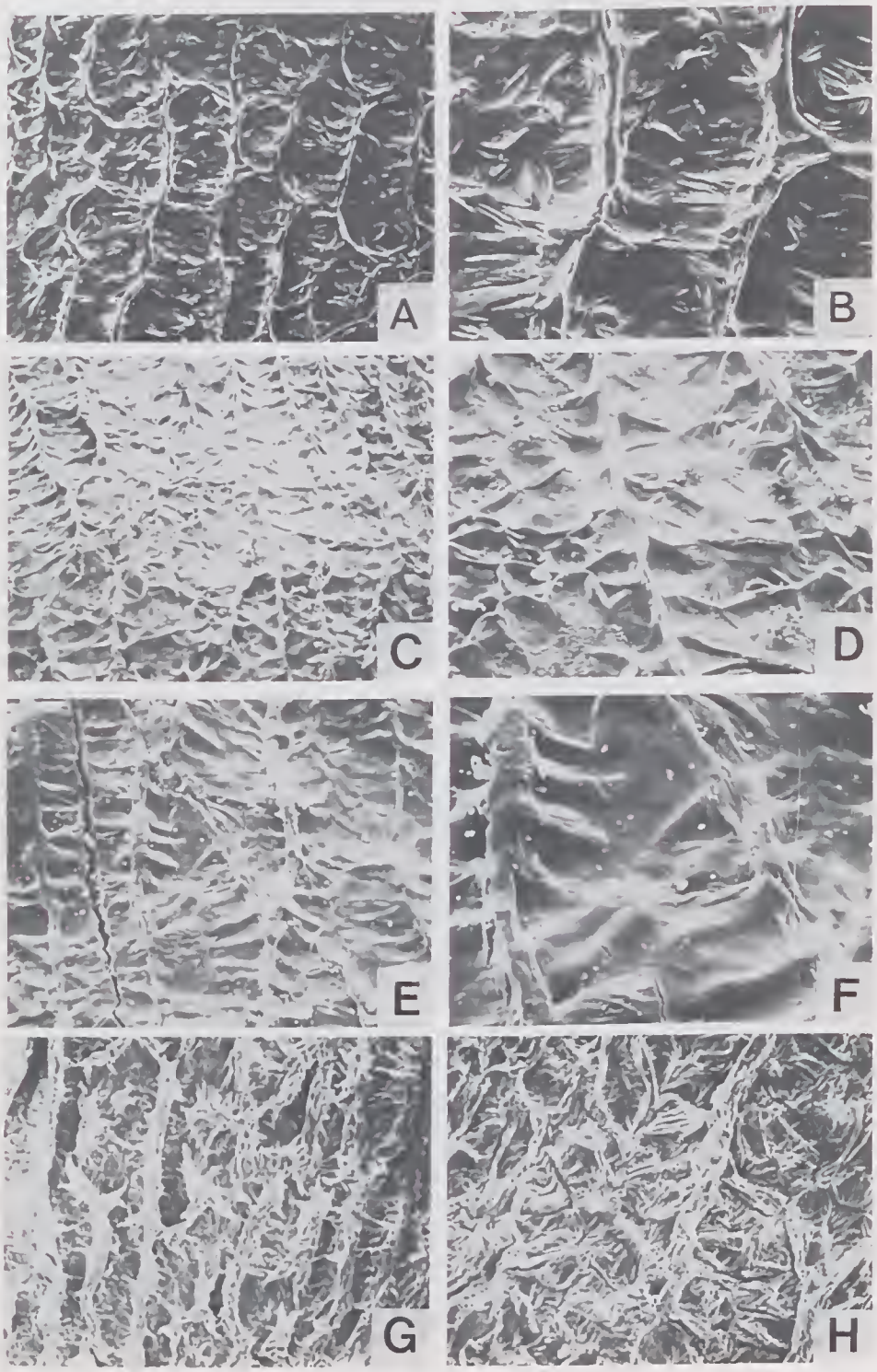

Fig. 11. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 29:** *Z.* sp. nov. '*C*' (55). C, D; **Pattern 30:** *Z. minutiflora* ssp. '*a*' (76). E, F; **Pattern 31:** *Z.* sp. nov. '*E*' ssp. '*a*' (76). G, H; **Pattern 32:** *Z.* sp. nov. '*G*' (119).

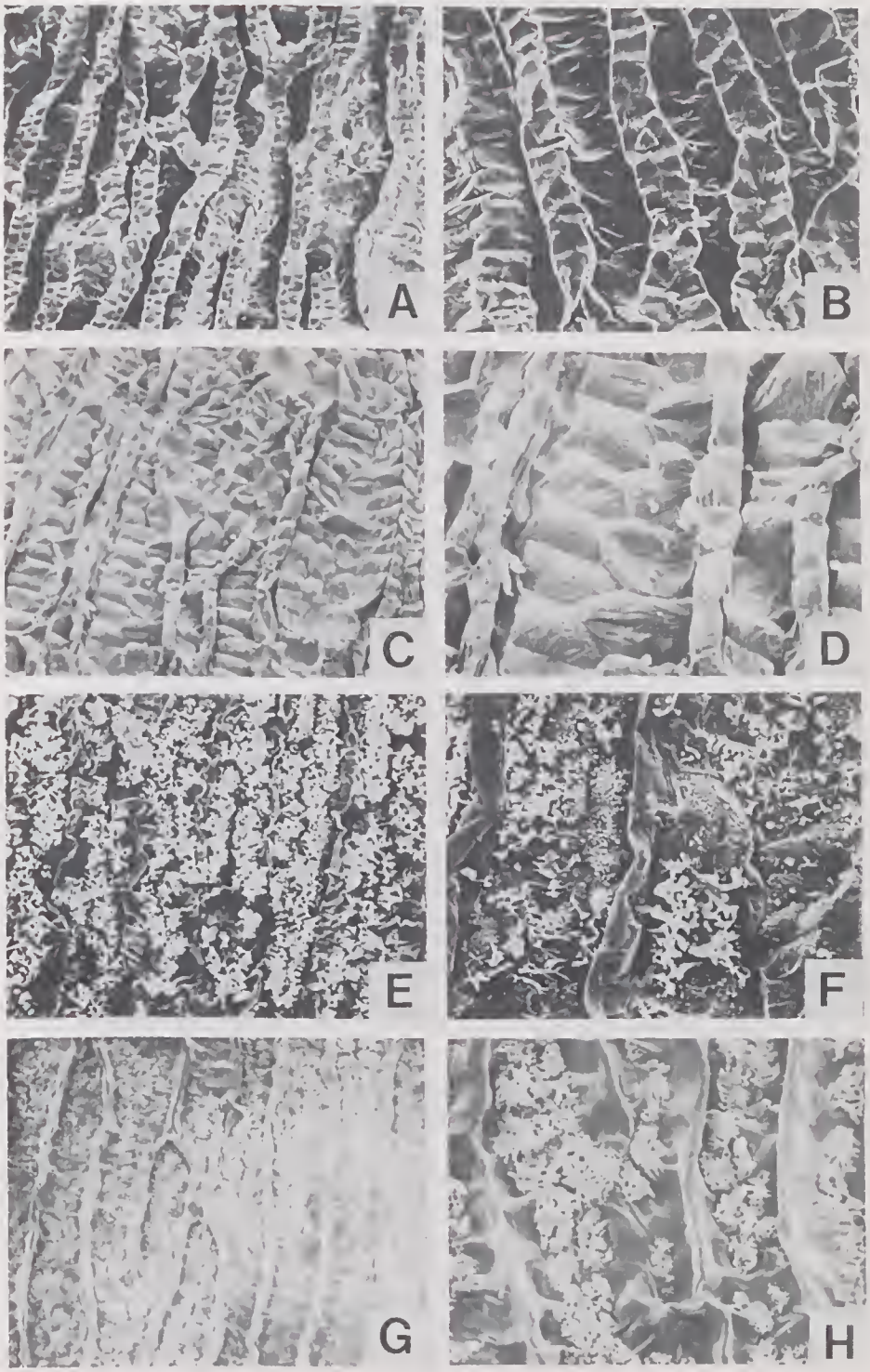

Fig. 12. Scanning electron micrographs of ridged seeds of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 33:** *Z. robusta* (92). C D; **Pattern 34:** *Z. murphyi* (84). E, F; **Pattern 35:** *Z. obcordata* (85). G, H; **Pattern 36:** *Z. aspalathoides* ssp. '*a*' (14).

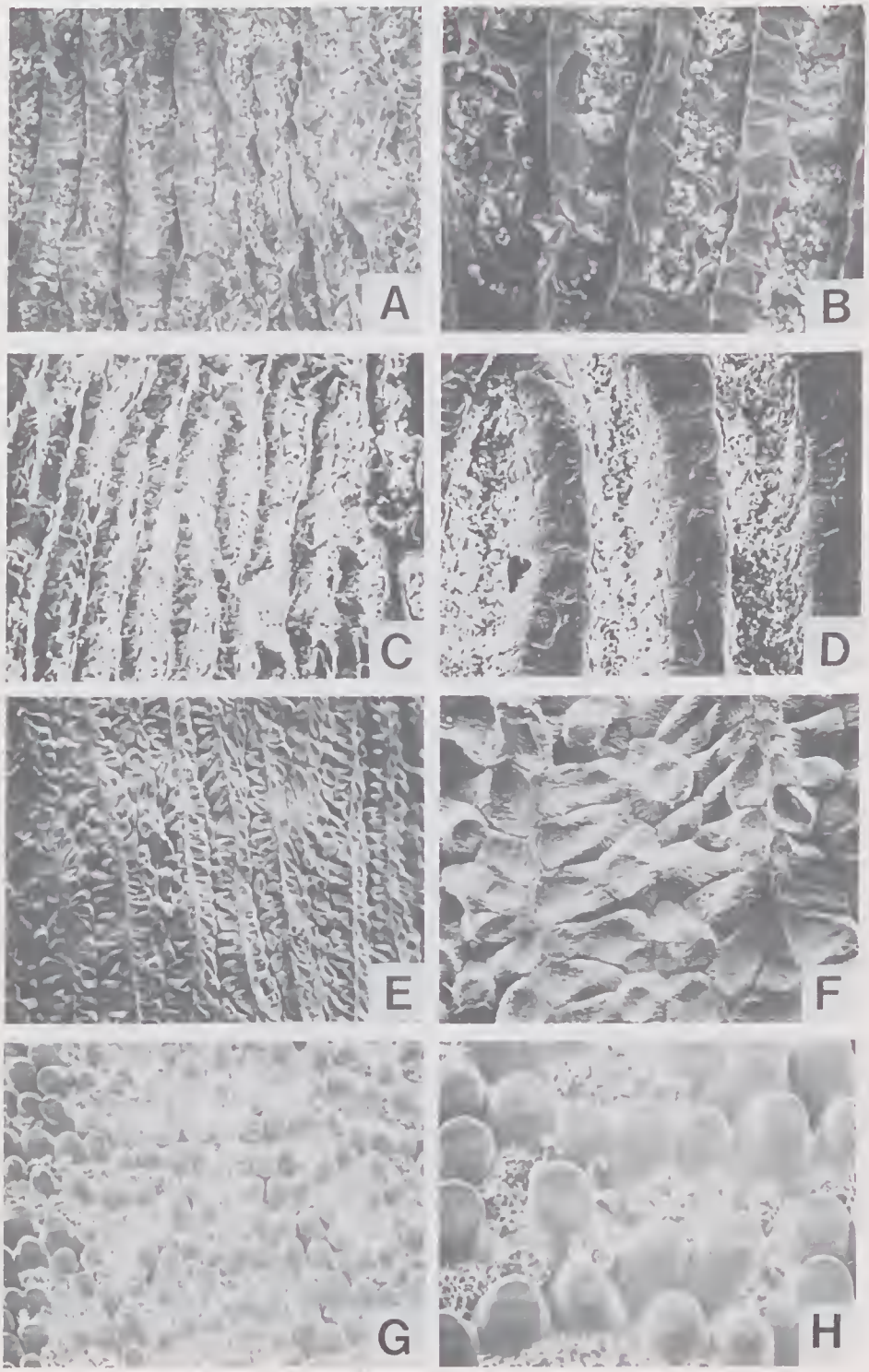

Fig. 13. Scanning electron micrographs of *Zieria*. A, C, E, G x 240; B, D, F, H x 600. Sample numbers in brackets. A, B; **Pattern 37:** *Z.* sp. nov. '*B*' (28). C, D; **Pattern 38:** *Z. veronicea* (118). E, F; **Pattern 39:** *Z. smithii* ssp. '*b*' (109). G, H; **Pattern 40:** *Z. pilosa* (86).

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We wish to thank the Directors of the following herbaria for the loan of specimens of *Zieria* for this study: AD, BM, BRI, CANB, CBG, Forestry Commission—Coffs Harbour, MEL and QRS; Dr M. Dickson and Mr B. Glas of the Electron Microscope Unit, University of NSW, for technical advice, Ms B. Bruin and Mr R. Roden for drawing the diagrams and Mr P. Finlay for help with the photographs. We are grateful also to Associate-Professor R. Carolin, Botany School, University of Sydney, and to our colleagues at the National Herbarium of New South Wales for helpful discussion of the manuscript.

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NOTES ON AUSTRALIAN TAXA OF *ACACIA* NO. 7.

Mary D. Tindale

(Accepted for publication 14.3.1980)

ABSTRACT

Tindale, Mary D. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, N.S.W., Australia 2000) 1980. Notes on Australian taxa of Acacia *No. 7. Telopea 2 (1): 113–125, figs 1–4.*—Two new phyllodinous species of *Acacia* (Family Mimosaceae) from the Northern Territory are described, namely *A. praetermissa* Tindale and *A. producta* Tindale. The characteristics of the phyllodinous *A. stigmatophylla* group from tropical Australia are discussed. A new record of a phyllodinous species, namely *A. jennerae* Maiden for western New South Wales, is cited. A new bipinnate species from south-eastern New South Wales, *A. olsenii* Tindale, is described.

INTRODUCTION

Two new species, *Acacia praetermissa* and *A. producta*, which I examined in the field during a visit in July 1979 to the Northern Territory, sponsored by the Australian Biological Resources Study, are described. In addition a new species, *A. olsenii*, and a new record, *A. jennerae*, are included in this paper, so that they may be listed in the forthcoming census of the Gymnosperms and Angiosperms of New South Wales.

SECT. JULIFLORAE (Benth.) Maiden & Betche

Acacia praetermissa *Tindale*, sp. nov.

Frutex usque 1.2 m altus, cortice truncorum laevi, schistacea, maculis albis parvis. Ramuli subglauci, glabri vel apicem versus pilis crispatis, griseis sparse ornati, teretes, purpureo-brunnei, lenticellis numerosis ornati, leviter costati. Phyllodia angustissime oblanceolato-elliptica, subcoriacea, falcata, 7.5–17 cm longa, 0.4–1.6 cm lata, late patentia, glabra vel pilis crispatis sparse induta, vena mediana prominenti, venis secundariis parallelis 2–4, venulis minoribus anastomosantibus, basin versus sensim angustata, apice obtuso vel late obtuso, acriter pungente mucrone adunco, supra pulvinum glandula orbiculari vel ovali 0.1–0.3 mm longa instructa, pulvino 1–2 mm longo. Stipulae atrobrunneae, anguste lanceolatae, caudatae, tenues. Spicae circiter 20–27 florae, aureae, solitariae vel binatae in axillis phyllodiorum exortae: pedunculi glabri vel pilis crispatis induti. Bracteae pallide brunneae vel atro-brunneae, fimbriatae, tenues, ovatae ad anguste lanceolatae. Bracteolae 0.5–0.6 mm longae, spathulatae, fimbriatae, petiolis brevibus. Flores 5-meri, in spicis laxe dispositi, ante anthesin orbiculares. Calyx circiter 0.5–1.0 mm longus; lobis acutis, partem quartam vel dimidiam longitudinis tubi acquantibus, costatis, apicem versus sparse fimbriatis. Corolla 1.5–2.0 mm longa, glabra, usque ad tertiam partem vel duas partes longitudinis tubi divisa, petalis acutis, costis prominentibus. Stamina numerosissima (circiter 55), filamentis 2.0–3.5 mm longis, antheris eglandulosis bilocularibus. Ovarium subsessile, brunneum, ovale vel oblongum, circiter 0.6–0.8 mm longum, sparse pilosum vel villosum; stylus circiter 2–5 mm longus; stigma non expansum Legumina plus minusve plana, oblique nervata, 4.5–7.5 cm longa, 0.8–1.0 cm lata, valvis ligneis, ex apice elastice revolutis, marginibus incrassatis praedita, anguste oblanceolata, apicem versus dilatata, apice mucrone brevi uncinato praedita, inter semina non contracta, basin versus sensim angustata. Semina brunnea, compresso-orbicularia, circiter 6 mm longa, circiter 4.5 mm lata, circiter 1.2 mm crassa, in legumine oblique disposita; areolus apertus, circiter 2.5–3.0 mm longus; funiculus-arillus albus, conicus. Fig. 1.

Fig. 1 R. A. Roden del.

Acacia praetermissa Tindale

a. Flowering branchlet, × ⅔. b. legume, × ⅔. c. seed, × 2. d. anther, × 26⅔. e. gland of phyllode, × 13⅓. f. base of phyllode showing pulvinus, × 4⅔. g. gynoecium, × 13⅓. h. flower, × 13⅓. i. bracteoles side and dorsal views, × 13⅓. Vouchers: a–f, h–i, (*M. D. Tindale 6030 & C. Dunlop*). g, (*N. G. Eddy 120*).

Shrub up to 1.2 m high, with a single trunk or tufted on a woody stock; bark smooth, bluish grey with small white blotches. *Branchlets* subglaucous, glabrous or clothed towards the apex with crisped grey hairs, terete, purplish brown, bearing numerous lenticels, lightly ribbed. *Phyllodes* very narrowly oblanceolate-elliptical, subcoriaceous, falcate, 7.5–17 cm long, 0.4–1.6 cm broad, spreading widely, glabrous or sparsely clothed with crisped grey hairs, the midrib prominent, with 2–4 secondary parallel veins and loosely anastomosing minor veinlets, tapering gradually towards the base, the apex obtuse or broadly rounded with a hooked pungent-pointed mucro, the pulvinus 1–2 mm long, with an orbicular or oval gland 0.1–0.3 mm long above the pulvinus. *Stipules* dark brown, narrowly lanceolate, caudate, thin. *Spikes* c. 20–27 flowers, golden, single or in pairs, borne in the axils of the phyllodes; peduncles glabrous or clothed with crisped hairs. *Bracts* light to dark brown, thin, fimbriate along the margins, ovate to narrowly lanceolate. *Bracteoles* 0.5–0.6 mm long, spathulate, fimbriate, the stalks short. *Flowers* 5-merous, loosely arranged on the spikes, orbicular in bud. *Calyx* c. 0.5–1.0 mm long, the lobes acute, dissected from $\frac{1}{4}$–$\frac{1}{2}$ of the length of the tube, with a midrib, sparsely fimbriate towards the apex. *Corolla* 1.5–2.0 mm long, glabrous, dissected from $\frac{1}{3}$–$\frac{1}{2}$ of its length; petals acute, each with a prominent midrib. *Stamens* very numerous (c. 55), the filaments 2.0–3.5 mm long, the anthers eglandulose, bilocular. *Ovary* subsessile, brown, oval or oblong, c. 0.6–0.8 mm long, sparsely pilose or villous; style c. 2–5 mm long; stigma not expanded. *Legumes* ± flat, obliquely nerved, 4.5–7.5 mm long, 0.8–1.0 cm broad, with woody valves and thickened margins, opening by rolling back elastically from the apex, narrowly oblanceolate, usually expanded towards the apex, which has a short hooked mucro, not constricted between the seeds, gradually narrowed towards the base. *Seeds* greenish brown, compressed-orbicular, c. 6 mm long, c. 4.5 mm broad, c. 1.2 mm thick, oblique in the legume, the pleurogram light brown, the areole open, c. 2.5–3.0 mm long, the funicle-aril white, conical.

HOLOTYPE: 1.5 km N. of Emerald Springs Roadhouse, Stuart Highway, Northern Territory, c. 13° 37′ S, c. 131° 37′ E, very spindly shrub 0.9–1.2 m high, trunk c. 1.3 cm diam. at 90 cm high, bark bluish grey with small white blotches, canopy small and loose, inflorescences golden, fruit green to brown, growing in slatey soil, in *Eucalyptus alba–E. dichromophloia* woodland with *E. tetrodonta* regrowth, *Livistona humilis* and *Ficus racemosa*, *M. D. Tindale 6102 & C. Dunlop*, 12.vii.1979 (NSW). ISOTYPES: BRI, CANB, CBG, DNA, K, US.

DISTRIBUTION: Emerald Springs–Pine Creek district, in the northern part of the Northern Territory, on hillsides in stony soil in eucalypt woodland.

FLOWERING PERIOD: mature flowers present in March and July, but very few specimens available for study.

FRUITING PERIOD: young fruit in March, mature pods in July but few collections were available.

SPECIMENS EXAMINED: NORTHERN TERRITORY: NW. of Pine Creek, 13° 39′ S, 131° 39′ E, *S. T. Blake 16329*, 7.1946 (BRI, NSW); c. 5 miles [c. 8 km] N. of Pine Creek, 13° 37′ S, 131° 47′ E, *N. G. Eddy 120*, 3.1958 (NT, NSW).

The specific epithet 'praetermissa' means easily overlooked. Even when they are in full bloom, plants of this species are rather insignificant.

A. praetermissa would be classified as a member of the *Juliflorae* according to the schemes of Bentham (1864 and 1875) and Pedley (1978), but in Vassal's classification (1972) it would be placed in the subgen. *Heterophyllum* sect. *Heterophyllum* subsect. *Spiciferae*.

There appear to be no very close allies of *A. praetermissa*. However it has some features of the *A. stigmatophylla* species-complex (see page 118) and may be compared with the latter group, from which it differs in the following respects:—minor veinlets between the 3–5 parallel main veins very loosely anastomosing, ribs of the branchlets not minutely convoluted and the seeds compressed-orbicular.

GROUP OF ACACIA STIGMATOPHYLLA

Acacia producta *Tindale*, sp. nov.

A. stigmatophyllae A. Cunn. affinis sed differt: inflorescentiis globosis, valvis leguminum concoloribus et inter semina dissepimentis tenuibus. Fig. 2.

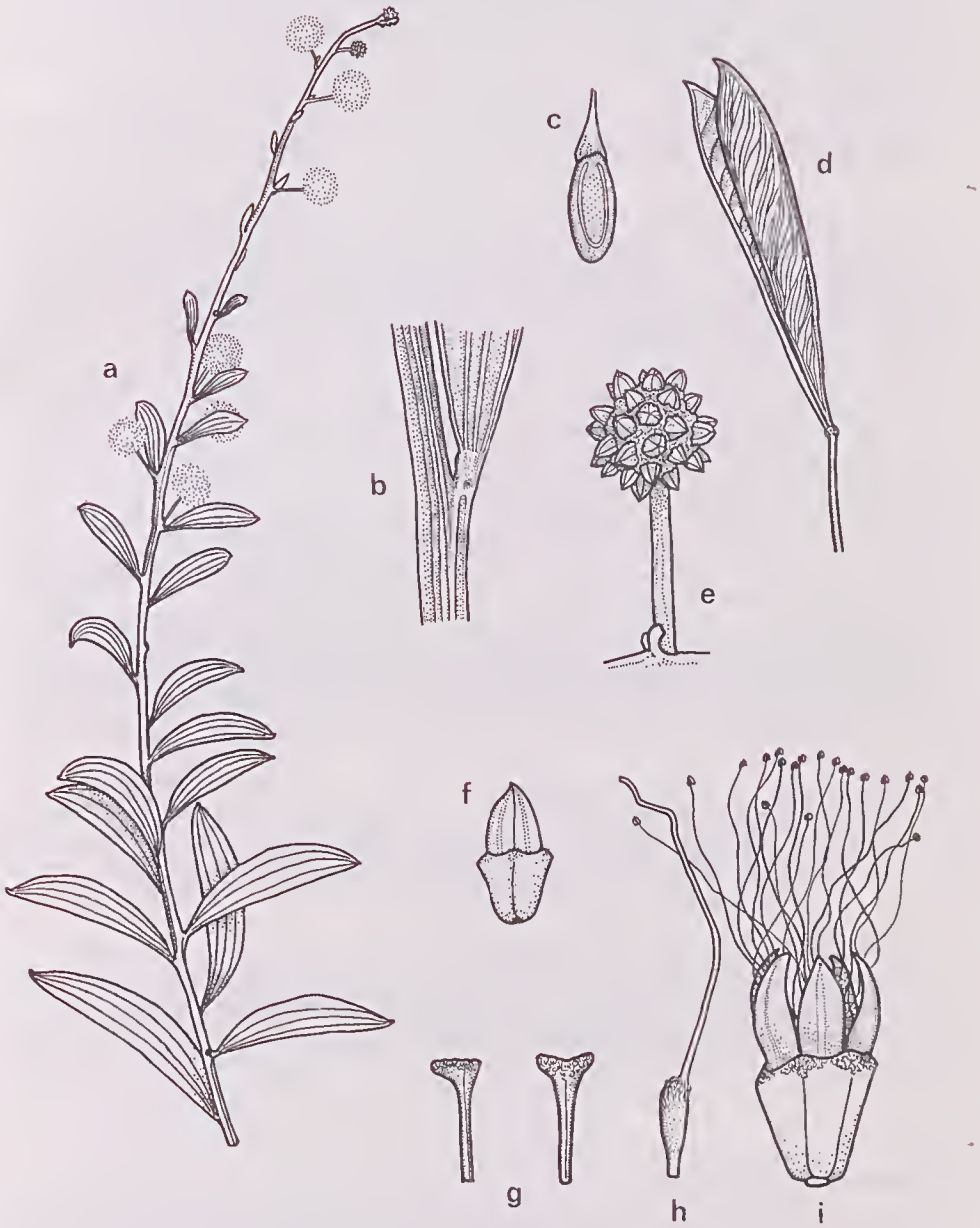
Spindly or bushy, erect or sometimes prostrate, resinous shrub up to 1.5 mm high and 2 m wide, with virgate branches bearing the inflorescences, single-stemmed or branched near the ground, bark dark grey and smooth. *Branchlets* angled to almost flattened and yellowish-fawn towards the upper parts, otherwise terete and brownish, the ribs yellowish and often minutely convoluted, sparsely clothed with short, white, appressed hairs when young. *Phyllodes* narrowly oblanceolate to oblanceolate or very narrowly oblong-elliptical to narrowly oblong-elliptical, straight or slightly falcate, 3–7.5 cm long, 0.5–1.5 cm broad, often resinous especially towards the apex when young, usually with 3 prominent, parallel main veins reaching the base or one of them sometimes confluent with the lower margin, 2–4 parallel semi-prominent veins and very closely spaced, parallel, ± anastomosing minor veinlets, the apex with an obliquely placed, rarely hooked mucro less than 1 mm in diam., the margin pale and often minutely convoluted, the base slightly oblique and with a cluster of short white hairs, the farinose pulvinus 1–2.5 mm long, the gland conspicuous just above the pulvinus. *Capitula* 5–11 mm in diam., bright yellow, viscid when young, single or in pairs in the axils of small modified phyllodes, borne on erect virgate branches; peduncles c. 5–14 mm long, 0.7–1.0 mm broad, slightly viscid, tawny, prominently ridged, glabrous except for a few, short, white hairs around the base. *Bract* red-brown, clothed with short, white, appressed hairs. *Bracteoles* 1.2–1.5 mm long, fawn, the stalk long, narrow and fimbriate towards the apex, the expanded, peltate, apical portion fimbriate. *Flowers* 5-merous, bright yellow, 19–27 per capitulum, acute in bud. *Calyx* 0.5–1.2 mm long, glabrous except for a few white hairs on the lobes, cupular, scarcely dissected into very short lobes with a darker yellow midrib and apex. *Corolla* 1.5–2.5 mm long, the petals 0.4–0.6 mm broad, dissected to c. ½ of its length, tubular, glabrous, the midrib and apical portion orange-tawny. *Stamens* numerous, 3.4–6.5 mm long, the anthers eglandulose and biloculate. *Ovary* subsessile, narrowly oblong, golden yellow to red-brown, 0.6–1.4 mm long, clothed rather densely with stiff, white hairs especially towards the obtuse apex, the style c. 2–3 mm long, glabrous, affixed to one side of the apex, the stigma not expanded. *Legumes* tawny, greenish-brown to red-brown, resinous when young, scurfy, opening elastically from the apex, woody, flat but thick, straight or slightly falcate, 3.9–5.7 cm long, 3.2–4.5 mm broad, with conspicuous diagonal veins, the margins prominent, the surface and margins very sparsely clothed with short white hairs and sometimes a few longer hairs, the apex broader and hooked, the base tapering gradually. *Seeds* dull, dark brown, compressed, irregularly oblong-elliptical, oblique in the legume and separated by thin partitions, the pleurogram pale-coloured, the areole open, the funicle stiff, c. 1 mm long, expanded into a cupular axil on top of the seed, the combined "funicle-aril" cream-coloured or tawny, conical, 2–4 mm long.

HOLOTYPE: near the Caravan Park, Katherine National Park, 14° 20′ S, 132° 22′ E, Northern Territory, shrub 1.5 m high, with bright yellow inflorescences, in very sandy soil in open *Eucalyptus phoenicea—Buchanania obovata* woodland, *M. D. Tindale 6080 & C. Dunlop*, 10.vii.1979 (NSW). ISOTYPES: CANB, DNA, K.

DISTRIBUTION: NORTHERN TERRITORY: north of latitude 16° 05′ S, in sand, sandy loam or sandy silts, mostly in eucalypt woodland (usually *Eucalyptus clavigera*, *E. miniata*, *E. phoenicea* and *E. tetrodonta*), but also in shrubby heathland and in seasonal swamps, often associated with *Triodia* spp., frequently occurring on rocky plateaux and mostly on laterite or sandstone.

FLOWERING AND FRUITING PERIODS: all the year (C. Dunlop, pers. comm.).

Fig. 2 R. Griffiths del.



Acacia producta Tindale

a. Flowering branchlet, × ⅔. b. branchlet and base of phyllode, showing the pulvinus, × 3⅓. c. seed, × 3⅓. d. legume, × 1. e. capitulum in bud, × 4. f. flower bud, × 10. g. bracteoles, side and dorsal views, × 13⅓. h. gynoecium, × 13⅓. i. flower, × 13⅓. Vouchers: a–b. (*R. A. Perry 1855*). c–i. (*M. Lazarides 7622*).

Specimens Examined: 5 miles [8 km] E. of Goyder River Crossing, 12° 51′ S, 135° 05′ E, *J. R. Maconochie 1480*, 6.1972 (NSW, NT 35808); 5 miles [8 km] NE. of Goyder River Crossing, 12° 51′ S. 135° 05′ E, *N. Byrnes 2643*, 6.1972 (BRI, CANB, DNA, NSW, NT); 13° 11′ S, 133° 00′ E, *M. Lazarides 7617*, 7.1972 (BRI, CANB, DNA, K, L, NSW); 13° 15′ S, 133° 12′ E, *M. Lazarides 7622*, 7.1972 (BRI, CANB, DNA, K, L, NSW, US); 13° 19′ S, 132° 31′ E, (c. 21.7 km N. of El Sharana Mine), *M. Lazarides 7862*, 2.1973 (CANB, NSW); 13° 28′ S, 132° 37′ E, (c. 12.8 km NE. of El Sharana Mine), *M. Lazarides 7868*, 2.1973 (CANB, NSW); levee of Katherine River, Stuart Highway, 14° 28′ S, 132° 16′ E, *M. D. Tindale 6041 & C. Dunlop*, 7.1979 (A, AD, BRI, CBG, MEL, PERTH, US); Bing Bong Road, c. 15° 37′ S, 136° 20′ E, *C. H. Gittins 1321*, 7.1967 (NSW 101460).

The specific epithet 'producta' refers to the elongated virgate branches bearing the capitula.

Acacia producta differs from *A. stigmatophylla* in its globose inflorescences, concolorous valves of the legumes and thin partitions between the seeds. The latter species is characterized by distinctive legumes with light reddish or fawn patches on the outer surface of the woody valves coinciding with the oblique seeds inside the fruit, and brown oblique stripes corresponding with the thick partitions between the seeds.

A. producta is a member of the previously unrecognized, tropical Australian group of *A. stigmatophylla* which cuts across previous classifications and is distinguished by the following characteristics:—Shrubs up to 1.5 m high, mostly resinous. *Branchlets* with translucent ribs which are usually minutely convoluted. *Phyllodes* multinerved usually with 1–3 parallel main veins, several parallel secondary veins and minor veinlets which are closely spaced with slight anastomoses. *Inflorescences* globose or spicate. *Flowers* 5-merous. *Calyx* not deeply lobed, the sepals mostly with a midrib. *Petals* with a midrib. *Legumes* opening elastically from the apex, narrowly oblanceolate, the woody flat valves with oblique veins and prominent margins on the outer surface and partitions between the seeds on the inner surface, the apex hooked, the base tapering gradually. *Seeds* dark brown or blackish-brown, ± oblong-compressed, oblique in the legume, the pleurogram pale-coloured, the areole open and the funicle-aril cream-coloured or tawny, conical. To this group belong:

1) the following taxa with capitula:

A. producta, *A. translucens* A. Cunn. ex Hook., *A. setulifera* Benth., *A. nuperrima* E. G. Baker subsp. *nuperrima* and *A. yirkallensis* Specht

2) the following taxa with spicate inflorescences:

A. stigmatophylla, *A. wickhamii* Benth., *A. nuperrima* E. G. Baker subsp. *cassitera* Pedley, *A. oncinocarpa* Benth., and *A. drepanocarpa* F. Muell.

1) Species with capitula

The first four above-mentioned species with capitula would be placed in the *Plurinerves* by Bentham (1864 and 1975) as well as Pedley (1978) and in the subgenus *Heterophyllum* sect. *Heterophyllum* subsect. *Globiferae* by Vassal (1972). *A. yirkallensis* was classified by R. L. Specht (1958: 233) as a member of the *Uninerves* closely allied to *A. gnidium*, when he described the former species from the Northern Territory. Certainly the midrib of the phyllodes in *A. yirkallensis* is prominent thus suggesting the *Uninerves* but there is also a rather insignificant, parallel, secondary vein on each side of the midrib. However, *A. gnidium* does not belong in the *A. stigmatophylla* group, as the fruit is very different.

A very common member of this group is *A. translucens* but it differs from *A. producta* in the following respects:—the phyllodes are mostly smaller (0.8–4.5 cm long and 0.8–1.5 cm broad), less distinctly veined, usually falcate, asymmetrical with the upper side very convex and the lower ± straight or slightly concave. The fruit and seeds are similar to those of *A. producta* and *A. nuperrima*, but are concolorous not as in *A. stigmatophylla* and *A. wickhamii*.

A. setulifera is an uncommon species from the Northern Territory and north-west Western Australia. It is allied to, and should perhaps be included with, *A. nuperrima*. The falcate phyllodes are 5–12 mm long and 2–5 mm broad with a characteristic, apical, very oblique, bristle-like appendage.

A. nuperrima which ranges from NE. Queensland to the northern portion of Western Australia is morphologically rather similar to *A. producta* except for the smaller, down-curved or sigmoid phyllodes 1–2 cm long and 2–5 mm broad, an oblique mucro at the apex of each phyllode and smaller, 10–20 flowered capitula 3–7 mm in diameter. Pedley (1978: 188–9) described *A. nuperrima* subsp. *cassitera* in which the inflorescence is a spike but may be reduced to a capitulum even on the same plant, whereas in subsp. *nuperrima* the inflorescence is always globose.

2) Species with spicate inflorescences

Traditionally, Australian species of *Acacia* with spicate inflorescences have been placed in the *Juliflorae* except the *A. drummondii* group in the Pulchellae and *A. dorothea* Maiden, which is closer to the *Uninerves Racemosae* (see Tindale and Roux, 1974: 838).

A. stigmatophylla, *A. wickhamii*, *A. oncinocarpa* and *A. drepanocarpa* were classified as *Juliflorae* by Bentham (1864 and 1875). *A. nuperrima* subsp. *cassitera* is retained in the *Plurinerves* by Pedley (1978) with subsp. *nuperrima*, despite its often spicate inflorescence. Vassal would place the first four above-mentioned species in subgen. *Heterophyllum* sect. *Heterophyllum* subsect. *Spiciferae*.

Although *A. stigmatophylla* has elongated spicate inflorescences and has been traditionally classified as a member of the *Juliflorae*, it is morphologically very similar to *A. producta* which has often been misdetermined as the former species despite the capitula. They share the same habitat preferences. Both are small resinous shrubs with virgate branches and very narrowly to narrowly elliptical oblong (6:1 to 3:1), thinly coriaceous phyllodes with thickened, minutely convoluted margins.

A. wickhamii is a wide-ranging species in tropical Australia. Pedley (1978: 136) comments that 'It is rather isolated in the *Juliflorae* but it is similar, particularly in characters of the pod, to *A. nuperrima* subsp. *cassitera* in the *Plurinerves*'. The fruits of *A. wickhamii* are distinctive being very similar to those of *A. stigmatophylla*.

The other two species in the *A. stigmatophylla* group, viz. *A. oncinocarpa* and *A. drepanocarpa* show no tendency towards globose inflorescences.

This group has not been formalized as a section or subsection, as further investigations are necessary. However it is evident that there is a breakdown in the circumscription of the Sections *Plurinerves* and *Juliflorae*.

Fig. 3 R. Griffiths del.

Acacia jennerae Maiden

a. Seed, × 1. b. legume, × ⅔. c. pulvinus, × 3⅓. d. flowering branchlets, × ⅔. e. flower, × 13⅓. f. braeteole, × 13⅓. g. gynoeeium, × 13⅓. h. flower bud, × 6⅔. i. capitulum in bud, × 3⅓. j. phyllode and branchlet, × ⅔. k. anther, × 40. Vouchers: a. (*I. V. Newman 795*). b. (*I. P. George NSW 108158*). c–i, k. (*I. P. George NSW 108157*). j. (*G. M. Cunningham 5401*).

SECT. PHYLLODINEAE DC.

Acacia jennerae *Maiden*

Acacia jennerae Maiden in Ewart and Davies, Flora of the Northern Territory: 333 (1917).

HOLOTYPE: at waterhole, about 80 miles [c. 129 km] NE. of $\frac{C}{T}$ 2 [Camp 2], Northern Territory, *G. F. Hill 295*, 8.vi.1911 (NSW).

The recent discovery of *Acacia jennerae* on the Far Western Plains of New South Wales represents a considerable extension of range for this species which also occurs in the Northern Territory and south-western Western Australia. As this is a poorly known species, the specimens which I have examined from the two latter regions are also included. It is a shrub or tree usually 2–4.5 m high with greyish green phyllodes and golden, globose flower-heads.

An illustration of the phyllodes and flowers accompanied the original description by J. H. Maiden (1917) but the very elongated, black or brownish, moniliform legumes were unknown at that time. However, the latter have been depicted in Fig. 3 by Miss Robin Griffiths.

A. jennerae was classified by Maiden as a member of the *Uninerves Racemosae*. According to Vassal's scheme (1972) it would belong to subgen. *Heterophyllum* sect. *Uninervea* and according to Pedley's scheme (1978) to subgen. *Heterophyllum* sect. *Phyllodineae*. This species is a member of the *A. microbotrya* group.

DISTRIBUTION: Far Western Plains of New South Wales, the southern region of Northern Territory and the Menzies–Southern Cross region of the south-west of Western Australia. It occurs in sandy soil on plains, often along the banks of streams or near salt lakes, in *Eucalyptus-Acacia* savannah, in *Atriplex-Eucalyptus loxophleba* woodland and in *Casuarina-Heterodendrum oleifolium-Myoporum platycarpum* scrub.

FLOWERING PERIOD: March–August.

FRUITING PERIOD: probably April–November.

SPECIMENS EXAMINED: NORTHERN TERRITORY: Crown Creek, [c. 8.1 km] W. of "Coniston" H.S. [22° 10′ S, 132° 25′ E], *G. Chippendale NT 2076*, 5.1956 (NSW, NT); Napperby Creek, NW. Stock Route [22° 26′ S, 132° 48′ E], *G. Chippendale NT* 1213, 6.1955 (NSW, NT); New Haven, 22° 46′ S, 131° 00′ E, *C. Dunlop 2542*, 5.1972 (NSW, NT); S. of "Central Mt Wedge", [c. 22° 51′ S, 131° 50′ E], *G. Chippendale NT 1214*, 6.1955 (NSW, NT).

WESTERN AUSTRALIA: **South Western Interzone:** Menzies, 29° 42′ S, 121° 02′ E, *M. D. Tindale 19 & E. M. Bennett* 3.1970 (AD, K, MEL, NSW, PERTH); 32 km E. of Southern Cross, [31° 13′ S, 119° 22′ E], *P. G. Wilson 4043*, 4.1966 (NSW, PERTH); 16.6 miles [c. 26.7 km] W. of Southern Cross on the Great Eastern Highway, in *Atriplex-Eucalyptus loxophleba* woodland, *M. D. Tindale 65 & E. M. Bennett* 3.1970 (CANB, MEL, NSW, PERTH).

NEW SOUTH WALES: **Far Western Plains:** 23.3 km S. of Coonavittra Tank on Wilcannia–Cobar Rd, 31° 32′ S, 144° 29′ E, *G. M. Cunningham 5401*, 6.1978 (AD, CANB, CBG, K, MEL, NSW, PERTH); 81 miles [c. 130 km] E. of Wilcannia, (i.e. 14 miles [22.5 km] E. of Coonavittra Tank), on Barrier Highway, Wilcannia–Cobar region, *I. V. Newman 795*, 9.1973 (NSW, wood sample for phytochemical survey); Highway 79, 8–11 miles [c. 13–18 km] N. of Coombah, *I. P. George NSW 108158*, 5.1977 (NSW); 5 km N. of Coombah, on Highway 79, 32° 54′ S, 141° 37′ E, *I. P. George NSW 108157*, 4.1977 (NSW).

Fig. 4 R. Griffiths del.

Acacia olsenii Tindale

a. Pods, × ⅔. b. capitulum in bud, × 3⅓. c. glands at base of rhachis, × 6. d. apex of pinna, × 8. e. apex of rhaehis, × 6. f. petiole, × 2. g. bractcoles, dorsal views showing the range of variation, × 13⅓. h. gynoecium, × 13⅓. i. flower, × 13⅓. j. bud, × 13⅓. Vouchers: a, d. (*I. Olsen 3094*). b–c, e–j. (*R. Coveny 6357, P. Hind & M. Parris*).

SECT. **BOTRYCEPHALAE** (Benth.) Taub.

Acacia olsenii *Tindale*, sp. nov.

A. storyi Tindale arcte affinis sed differt: floribus in capitulo paucioribus (7–12), capitulis aureis, petalis liberis, paribus pinnularum numerosioribus (52–106), marginalibus pinnularum ciliis majoribus albis. Fig. 4.

Tree 4–15 m high; bark of the trunk smooth except sometimes slightly corrugated towards the base in older trees, grey-green, dark grey, brown or black. *Branchlets* bluish glaucous, mostly glabrous but rarely very sparsely clothed with fine, spreading, white hairs along the non-prominent ridges, terete except for the young branchlets often vertically flattened. *Young tips* brownish-green or cream-coloured. *Leaves: petiole* 1.5–3.7 cm long, bluish glaucous, vertically flattened, glabrous or sometimes clothed with sparse, short, white hairs usually along each ridge, bearing 1 prominent spherico-depressed, mostly glabrous gland near the base of the lowest pair of pinnae; *rhachis* 5.5–9 cm long, dull brownish green, somewhat vertically flattened, usually with a spherico-depressed gland at the base of each pair of pinnae and sometimes also with 1 or 2 similar but smaller, often contiguous glands. *Pinnae* 9–17 pairs, 3.7–7.6 cm long, c. 2.5–6.0 mm broad, dark green, not glaucous. *Pinnules* c. 52–106 pairs, c. 1–2.5 mm long, c. 0.5–0.7 mm broad, feathery, glabrous except for white cilia along the margins, ± oblong to linear, the apex subacute with a tuft of short white hairs. *Capitula* deep yellow, globose, 7–12 flowers in head, borne in racemes or panicles, the peduncles glabrous. *Bract* at the base of the peduncle deltoid, light brown, with very short, fine, white hairs along the margin, sometimes a smaller bract towards the middle of the peduncle. *Bracteoles* 0.5–0.7 mm long, with a narrow, red-brown, fimbriate petiole expanded into a fimbriate, deltoid or peltate, apical portion. *Calyx* 5-merous, 0.3–0.7 mm long, obconical, dissected to $\frac{1}{8}$–$\frac{1}{5}$ (–$\frac{2}{3}$) of its length, glabrous or densely pubescent with white hairs, pale yellow with red-brown tips. *Corolla* 1.0–1.4 mm long, red-brown at the base but deep yellow above, with darker midribs and apices on the 5 free, acute or subacute petals with granular margins. *Stamens* numerous, 2.0–2.6 mm long, anthers eglandulose and bilocular. *Ovary* 0.4–1.2 mm long, sessile or subsessile, bluish glaucous, glabrous, oval or ± oblong; style glabrous, laterally attached, c. 2.5 mm long; stigma expanded slightly. *Legumes* glaucous, bluish grey, submoniliform, thinly coriaceous, (5–) 10–11 (–12) cm long, 0.6–0.8 cm broad, glabrous with a fairly prominent margin. *Seeds* black, oblong-elliptical, slightly compressed, 6–12 in each legume, longitudinal in the fruit, the funicle filiform at first then expanded into a cream-coloured or tawny pileiform aril on top of each seed, the pleurogram black in seeds which are not quite mature, the areole open. Fig. 4.

HOLOTYPE: 3.2 km ENE. of Dampier trig on the Bendethera Caves fire trail, 53 km SSW. of Braidwood, New South Wales, alt. 900 m, 35° 59′ S, 149° 43′ E, small tree 3–4 m high, young branchlets glaucous, older branchlets dark grey with glaucous patches, otherwise bark dark grey and smooth, rarely slightly corrugated towards the base in older trees, flowers deep yellow; on steep scree hillside among loose stones with *Eucalyptus smithii*, *E. blaxlandii*, *E. fastigata*, *Beyeria lasiocarpa*, *Hakea macraeana*, *Prostanthera*, etc., a common tree at head of creeks, some plants seen 10–12 m high (often glaucous hue from a distance), *R. Coveny 6532*, *P. Hind & M. Parris*, 18.v.1975 (NSW). ISOTYPES: A, AD, B, BRI, CANB, CBG, CHR, K, L, LE, MEL, NU, P, PERTH, UC, US, Z.

DISTRIBUTION: NEW SOUTH WALES: **Southern Tablelands:** Bendethera Caves–Dampier trig fire-trail, Minuma Range, southwards to Mother Woila, Tabletop Mountain and the Tuross River. This species is of scattered occurrence or forms stands usually less than 50 m from creeks on very steep, dry, rocky hillsides with a NW. aspect at the heads of gullies and on the tops of knife-edge ridges. It often grows in association with *Eucalyptus smithii*, *E. fastigata*, *E. fraxinoides* and a small form of *E. badjensis* (or possibly an undescribed related species) as well as *E. blaxlandii*, *E. olsenii*, *E. sieberi*, *Acacia falciformis* and *A. obtusifolia* in drier areas, and with *Casuarina cunninghamiana* on the banks of streams. *Acacia olsenii* usually occurs on scree and soil over slate and shale bedrock but sometimes also in alluvial sands.

FLOWERING PERIOD: May.

FRUITING PERIOD: November to January.

SPECIMENS EXAMINED: NEW SOUTH WALES: Southern Tablelands: 3.2 km ENE. of Dampier trig on the Bendethera Caves fire trail, 53 km SSW. of Braidwood, 35° 59′ S, 149° 43′ E, alt. 900 m, *R. Coveny 6358*, *P. Hind & M. Parris* 18.5.1975 (NA, NSW, NY, RSA, TL, TNS, U); E. of Big Badja Hill, ridge N. of Mother Woila, 3.7 km from Dampier trig, 36° 01′ S, 149° 39′ E, *M. D. Crisp 2377*, *D. J. Cummings & A. Tyrrel*, 30.11.1976 (NSW); Razorback approach to Mother Woila, 36° 03′ S, 149° 39′ E, 950 m alt., *I. Olsen 2053*, 13.4.1974; base of bluffs of Mother Woila, 36° 03′ S, 149° 39′ E, alt. 950 m abundant, *I. Olsen 3094*, 19.11.1977 (CANB, CBG, K, L, MEL, TL, UC, US, Z); Razorback ridge approach to Mother Woila, 36° 03′ S, 149° 39′ E, alt. 1 000 m, *I. Olsen 3091*, 19.11.1977 (AD, PERTH); ridge-top S. of Tabletop, 36° 04′ S, 149° 40′ E, *I. Olsen 2997*, 17.12.1976 (NSW); Tuross R, 14 km below Tuross Falls, 36° 12′ S, 149° 35′ E, *I. Olsen 3005*, 30.12.1976 (NSW).

This species is named in honour of Mr Ian Olsen, formerly Landscape Designer at the Royal Botanic Gardens, Sydney, since he drew this wattle to my attention. He collected this species on a bushwalking trip and subsequently returned to the Mother Woila region to obtain fruiting material at my request. The comparatively late discovery of *A. olsenii* must be attributed to the rugged terrain in which it grows.

It is a member of the ser. *Botrycephalae* according to the classification of Bentham (1864 and 1875) and to sect. *Botrycephalae* according to Pedley's scheme (1978) and to subgen. *Heterophyllum* sect. *Uninervea* according to Vassal's scheme (1972). *A. storyi* Tindale (1966) 147 is very closely allied to *A. olsenii* but differs in the following respects:—the capitula pale yellow and 15–20 flowered, less numerous pairs of pinnules (32–61) and the margins of the pinnules with fewer white cilia. There is a considerable disjunction in the distribution of these two species, as *A. olsenii* occurs in SE. New South Wales, on slate and shale or on interbedded slate and sandstone, whereas *A. storyi* has only been recorded from the Blackdown Tableland, Queensland, on sandstone. The latter species flowers from April to August and *A. olsenii* in May.

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I wish to express my appreciation to the Directors of the National Herbarium of Victoria and the Queensland Herbarium as well as to the Officer-in-Charge, Darwin Herbarium, for the loan of specimens. Special collections were made on my behalf by Mrs M. Parris, Dr I. V. Newman and Messrs G. Cunningham, R. Coveny, P. Hind and I. Olsen. I am also indebted to Mr R. A. Roden for preparing the illustration of *Acacia praetermissa* as well as to Messrs L. Pedley, and B. R. Maslin for discussions about some of the species, also to Messrs H. K. Airy Shaw and A. George for checking the Latin description of *Acacia praetermissa*.

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PSORALEA PALLIDA, A NEW SPECIES OF FABACEAE FROM ARID AUSTRALIA

NANCY T. BURBIDGE†

(Accepted for publication 2.11.1979)

ABSTRACT

Burbidge, Nancy T. (Herbarium Australiense, CSIRO, P.O. Box 1600, Canberra City, Australia 2601) 1980. Psoralea pallida, *a new species of Fabaceae from arid Australia. Telopea 2 (1): 127–128.—P. pallida*, a common inhabitant of the sand dunes of Central Australia and particularly of the Simpson Desert, extending into adjacent areas of Queensland, New South Wales and South Australia and into northwestern Victoria, is described.

Psoralea pallida *N. T. Burbidge*, **sp. nov.**

Species affinis *P. erianthae* Benth. sed plus tomentosa et flosculis majoribus.

Herba robusta, villoso-tomentosa, ramis striatis stipulis lanceolatis, acuminatis villosisque. *Folia* pinnati-trifoliolata, petiolata. *Foliola* rhomboidea vel ovata, obtusa, supra tomentosa, sparsim glandulosa, subter dense tomentosa, marginibus denticulatis interdum repando-denticulatis dentibus apiculatis. *Racemi* axillares, pedunculati, pedunculis quam folia subtenta brevioribus, raro longioribus. *Calyx* bilabiatus, dense villosus, 8–10 mm longus, lobo infimo cymbiforme tubum vix excendente, lobis lateralibus manifeste quam ceteros brevioribus. *Corolla* purpurascens, vexillo calycis lobo infimo vix excedente. *Legumen* villosum 3.5–4 mm longum.

HOLOTYPE: App. 22 miles [c. 35 km] south of Alice Springs, on railway line road. *N. T. Burbidge & M. Gray, 4379*, 29.9.1955 (CANB 241936). ISOTYPES: CANB, NSW; to be sent: K, PERTH.

Robust erect or ascendent herb, grey-pubescent or villous on all parts except the corolla. *Stems* striate, thickly tomentose-villous and without visible glands. *Stipules* lanceolate, acuminate, villous. *Leaves* pinnately trifoliolate, petioles 2–4 cm long; *leaflets* rhomboid-ovate, obtuse, incurved-undulate and apiculate-denticulate on the margins, tomentum thinner above but the glands few or obscured, terminal leaflet 3–5 cm long. *Racemes* axillary, loosely compact, pedunculate, not interrupted at the base. *Peduncles* usually shorter than the subtending leaves, vestiture as on stems. *Flowers* in threes, subsessile in the axils of ovate villous bracts 2 mm long. *Calyx* bilabiate, villous, 8–10 mm long; lowest lobe slightly longer than tube, laterals less than half as long and upper lobes about two-thirds as long as lowest. *Corolla* purplish, as long as lowest calyx lobe or slightly longer. *Pod* 3.5–4 mm long, villous especially towards the apex.

SPECIMENS EXAMINED: QUEENSLAND: **Gregory North:** "Currawilla", 100 miles [161 km] W. of Windorah, *Everist 3985*, 6.1949 (BRI). **Gregory South:** "South Galway", 45 miles [73 km] SW. of Windorah, *Everist 4038*, 6.1949, flowers pink and lowest lobe of calyx unusually long and upcurved (BRI); sandhills W. of Birdsville, *Everist & Smith 88*, 1.1937 (BRI); 90 miles [145 km] N. of Tibooburra, *Riek & Common 0212*, 11.1940 (CANB).

NEW SOUTH WALES: **Far Western Plains:** 10 miles [16 km] S. of "Cobham", *Riek & Common 0307*, 11.1949 (CANB); Cobham sand hills, *Morris* 10.1921 (BRI); Wilcannia, *Corbett* 10.1901 (K); Darling R., *Dallachy & Goodwin* (K); sandhills near Menindee, *Beckler, Victorian Expedition* (K).

† died 4 Mar 1977. This paper publishes manuscript left by Dr Burbidge, with slight emendation by Alma T. Lee (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney 2000).

VICTORIA: Mildura, *Williamson* 10.1928 (K).

SOUTH AUSTRALIA: **Lake Eyre Basin:** Bradys Waterhole, "Cordillo [Downs]", *Basedow 60*, 10.1919 (K).

NORTHERN TERRITORY: **Central Australia:** 30 miles [48 km] SW. of Alice Springs, *Gardner 11670*, 3.1953 (PERTH).

This species resembles *P. eriantha* and was confused with it by Domin [Biblioth. Bot. 22 (89²): 738 (1925)]. It differs in the more robust habit, larger flowers with a relatively longer lowest lobe to the calyx and in the denser pale grey vestiture. The pod is enclosed in the slightly oblique calyx in a similar fashion to that in *P. eriantha*. In some specimens where the calyx lobes are relatively long the lowest lobe is upcurved.

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THE *PSORALEA PATENS* COMPLEX

Alma T. Lee

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ABSTRACT

Lee, Alma T. (National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, Australia 2000) 1980. The Psoralea patens *complex. Telopea 2 (1): 129–141, figs 1–3.*—Collections from all mainland States of Australia (perhaps not fully representative of Western Australia and South Australia) under the names *P. pateus* Lindl., *P. australasica* Schltdl., *P. eriantha* Benth., *P. dietrichiae* Domin, *P. discolor* Domin and *P. pallida* N.T. Burb., are reviewed and types examined. The identity of the Holotype of *P. patens* (oldest name) is established. A classification is proposed, recognizing *P. patens* (incorporating *P. eriantha* and *P. discolor*), *P. australasica* (incorporating *P. dietrichiae*), and *P. pallida*, as heterogeneous species. Distribution maps are provided.

The description of *Psoralea pallida*, published on p. 127 of this issue, has been taken from an uncompleted manuscript revision of *Psoralea* in Australia, prepared c. 1955 by the late Dr Nancy Burbidge and treating, inter alia, the closest relatives of *P. pallida* already described as *P. patens* Lindl., *P. australasica* Schltdl., *P. eriantha* Benth., *P. dietrichiae* Domin and *P. discolor* Domin. In this manuscript, previously accepted taxonomy and nomenclature had been followed, viz. *P. patens* and *P. australasica* were assumed to be conspecific (thus *P. patens* by priority), and *P. eriantha* was regarded as another, prostrate, species (*P. dietrichiae* and *P. discolor* were of uncertain status). Burbidge had not seen the Type of the oldest name, *P. patens*, and its description was ineffective for typification. Being fully aware of the nomenclatural options dependent on this typification, she suggested specifically that I should investigate it.

Burbidge was perhaps not fully aware of the extent of the morphological complexity in the group, and increased collections have further blurred the distinctions between previously recognized taxa; also results of plant-breeding work in Queensland were not available at that time. Thus she thought four species could be distinguished (*P. patens*, *P. eriantha*, *P. australasica* and *P. pallida*), but also knew that 'if the erect forms [*P. australasica*] are removed, the prostrate forms [? *P. patens*, *P. eriantha*] are very difficult to separate'. My own conclusion has been that these last two taxa *cannot* be separated, and that the Type of *P. patens* falls among the prostrate forms and must not be associated with the erect *P. australasica*.

To comply with Burbidge's wish that I should bring appropriate parts of her manuscript to early publication, it was necessary to investigate the whole complex of plants associated with the above names. Problems emerged both in delimitation of taxa, and in nomenclature, as follows:—

(i) The taxa

Much of the complexity of form is found in Queensland, but the Western Australian part of the complex is perhaps not yet sufficiently known, and further variation may be found in the northwest of South Australia and adjacent areas.

Three major taxa can be recognized, though they lack clear-cut genetic barriers. They are not geographic races in the usual sense of that term, though much of the morphological variation is correlated with soil type. It seems that they constitute a single gene-pool, showing adaptive differentiation into forms that are established over wide areas, maintaining themselves without much change because inbreeding by self-fertilization is general, though not obligate. Outbreeding does occur in nature, and thus the whole population of the complex at any time contains the results of "hybridizations", most of which do not succeed in the current selection regimes and eventually disappear. Even the successful results of this process make up a very

heterogeneous assemblage, but taxa can be recognized, and for simplicity of nomenclature they are treated here as species. The breeding behaviour outlined is the subject of experiment at Queensland University (I. de Lacy pers. comm. 1979). One experiment records segregation for growth-habit from which it is deduced that—

(a) the prostrate habit is dominant when prostrate plants are crossed with non-prostrate members of the complex;

(b) this prostrateness is controlled by a simple genetic system: two pairs of alleles which are complementary in action;

(c) variation in erectness is also genetically controlled but by a more complex polygenic system.

(a) and (b) are consistent with the separation of a prostrate taxon (*P. patens*) from the rest of the complex and explain the rare occurrence of an erect plant in that species; (c) is consistent with the inclusion of various degrees or forms of erect habit in another taxon (*P. australasica*).

(ii) Nomenclature

I was able to examine the Holotype of *P. patens* in the Lindley herbarium at CGE in 1974. It consists of a shoot apex with a few leaves and inflorescences, so mounted on the sheet as to suggest erect growth, and the prostrate habit of its taxon is obscured. An Isotype at K, however, shows a longer, apparently weak stem, as indicated in the protologue. Flower and inflorescence characters shown by the Type are also not fully representative of its taxon; the inflorescences are narrower (due to smaller flowers) and more interrupted* than is usual. These characters, though matched in some specimens of *P. australasica* can equally be found in *P. eriantha*, a similar "species" described later but better known, *and* with a prostrate habit (*P. australasica* has erect or semi-erect stems).

It thus appears that, due to characters of the Holotype and its presentation, and to deficiencies in the protologue, the name *P. patens* has been misapplied to the taxon *P. australasica*, so that the inappropriate epithet *patens* has been applied to an essentially erect and often tall plant ("eine hohe Staude" in the protologue of *P. australasica*). After gaining some familiarity with widespread representatives of these populations, I am convinced that the Holotype of *P. patens* falls within a prostrate species which includes *P. eriantha* as an inseparable and major part, and that *P. australasica* can be treated as a distinct species. Burbidge had clarified the character of *P. australasica* from type material in MEL, and knew that my conclusion was one of the nomenclatural options.

The name *P. pallida* N. T. Burb. is now available for the third species, long-recognized but hitherto unnamed, which is included in the taxonomic treatment below.

PROPOSED CLASSIFICATION

The total population of this widespread and often locally common complex may be characterized as follows:

Soft-wooded shrubby plants, fully prostrate with several to many stems radiating from a central tap root, through "semi-erect" forms with few to numerous uncertainly or weakly erect stems, to fully erect plants (short or tall) branched along one or more

* Term used to indicate considerable and often somewhat unequal spacing between the triads of flowers, but essentially relative: wide spacing of small flowers appears more interrupted, especially when some have fallen and when flowers open in slow succession. A 'continuous' inflorescence has flowers crowded, or regularly spaced as when the flowers open in quick succession.

main stems. *Stems* usually densely clothed with softly spreading or downturned hairs together with fewer, longer, spreading, hairs obscuring the glands until thinned with age, but very rarely quite glabrous and then the glands conspicuous. *Leaves* pinnately trifoliolate, on petioles of very variable length, the leaflets basically ovate to trullate with variations in width, obtuse to truncate with a point at the apex, the margins apiculate-denticulate or sometimes repand-denticulate, but often entire at the base near the petiole; lateral leaflets slightly asymmetrical; surfaces glabrous to densely pubescent (the abaxial side usually more hairy) with loosely appressed to spreading hairs, the glands correspondingly conspicuous or obscured and varying in size, the veins, especially on lower surfaces, more conspicuously pubescent than the rest. *Inflorescences* axillary, racemes of almost sessile flowers in groups (usually of three) subtended by an ovate or narrower bract. *Peduncles* very short to long (less than 1 to more than 20 cm long), not always proportional to length of rachis. *Flowers* rather small, (4–) 6–9 (–11) mm long, with a densely pubescent calyx, the hairs black, grey, brown, white or mixed, and a pink, purple or bluish corolla scarcely to slightly (by up to 3 mm) exceeding the calyx. *Calyces* with lobes nearly level at the apex (i.e. nearly equal), to unequal, with the lowest lobe the longest and up to 2.5 times the length of the tube and clearly exceeding the lateral (shortest), and the upper (shorter) pairs. *Pod* ± enclosed in the calyx, silky-pilose, at least in part.

The following Key, and the Table of characters, distinguish the three species recognized here by the characters most commonly present in each. Variations from that "core" of characters are described under the appropriate species.

KEY TO THE SPECIES

(for fully typical specimens)

1. Stems erect. Aspect green. Inflorescence interrupted, the rachis and peduncle more or less equal, each often 7–10 cm long. Plants of heavy soils ..... *P. australasica* 1.

1.* Stems prostrate, or ascending and finally decumbent. Inflorescence continuous. Plants of sandy soils.

2. Stems prostrate or rarely erect. Aspect green (or grey-green in a Central Australian variant). Rachis of the inflorescence often 2–3.5 cm, sometimes almost capitate, usually shorter than the peduncle. Often in sandy creek beds or banks ..... *P. patens* 2.

2.* Stems ascending, then decumbent. Aspect grey to white. Rachis of the inflorescence often 4–8 cm, usually longer than the peduncle. Commonly on sand dunes .... *P. pallida* 3.

1. **P. australasica** *Schltdl.*, Linnaea 20: 668 No. 197 [misprint for 196] (1847); F. Mueller, Fragm. 3: 45 (1862) indicating synonymy with *P. patens*; N. T. Burbidge MS., in synonymy of *P. patens*, and in a note on the Isotype in MEL. ISOTYPE: 196 *P. australasica* leg. *Dr. Behr*, mis. v. Schlechtendal (MEL 89796 !); cited as "near Bethany [c. 5 km NE. of Adelaide, South Australia] mostly near water. Dec."

P. dietrichiae Domin, Biblioth. Bot. 22 (89²): 739 (1925). ISOTYPE: Rockhampton [Queensland–Port Curtis], *Dietrich 697*, ii.1866 (NSW !).

[*P. patens* sensu auct., non Lindl.: Benth., Fl. Austral. 2: 192 (1864); Tate, Handb. Fl. Extratrop. South Australia: 69 (1890); Moore & Betche, Handb. Fl. New South Wales: 146 (1893); F.M. Bailey, Queensland Fl. 2: 382 (1900); ? Ewart & Davies, Fl. Northern Territory: 144 (1917)—concept appears confused; Ewart, Fl. Victoria: 668 (1931); Black, Fl. South Australia edn 2: 463 (1948); Beard, Descr. Cat. West Austral. Pl.: 71 (1965); Willis, Handb. Pl. Victoria 2: 301 (1973). Although some element of the true *P. patens* may have been included in the concept expressed under that name in these publications, the greater part of their data is referable to *P. australasica*. Following Mueller l.c., the authors did not distinguish between these two species.]

Diagnostic characters as given in the Key and Table. *P. australasica* encompasses great variation in most of its characters, and trends are observed in

TABLE 1

Comparison of characters in *P. australasica*, *P. patens* and *P. pallida*
(see also figs 2, 3, 5)

P. australasica	*P. patens*	*P. pallida*
Habit		
Erect or semi-erect, short (c. 0.5 m) to tall (–2.5 m)	Prostrate (rarely erect; erect height not recorded)	Ascending, finally decumbent; often c. 0.6 m high
Inflorescence		
Interrupted	Continuous, usually compact	Continuous, often with some spacing of flowers
Long, on a long peduncle, much exceeding the leaf	Very short, sometimes almost sessile, to longer, often on a long peduncle	Of medium length but exceeding the leaves
Rachis (5–) 7–10 (–23) cm	(1–) 2–3 (–9) cm	(3.5–) 4–8 (–15) cm long
Peduncle (3–) 7–16 (–23) cm	(1–) 2–7 (–14) cm	(1–) 2–5 (–13) cm long
Diam. (6–) 10–15 (–18) mm	12 (–19) mm	(13–) 15–19 (–21) mm
[Rachis ± equal to peduncle]	[Rachis usually < peduncle but the reverse in atypical form]	[Rachis usually > peduncle]
Aspect		
Green	Green (or greyish in atypical forms)	Grey to whitish
Leaflets		
Glabrous to sparsely hairy above, usually pubescent below at least on veins	Glabrous or hoary above, usually more pubescent below (± tomentose in atypical forms)	Densely grey- to white-tomentose on both sides
Terminal leaflet		
(1.5–) 2.5–4 (–7.5) cm	(1–) 2–3 (–4) cm	(1.5–) 2–4 (–6.5) cm long
x (0.5–) 1.5–2 (–4) cm	x (0.7–) 1–1.5 (–2) cm	x (1–) 1.5–3 (–4) cm broad
Flower		
(4–) 6–7 (–8) mm	6–7 (–8) mm	(7–) 8–9 (–11) mm long
Corolla clearly > calyx (by c. 2 mm)	Corolla slightly > calyx (by c. 1 mm)	Corolla = or scarcely > calyx
Calyx		
Short, obconical, to open in fruit (more tubular, closed in fruit in longer forms)	Medium in length, ± tubular, not open in fruit	Long, tubular, not open in fruit
Tube (1.5–) 2 (–3) mm	(1.5–) 2–3 (–4) mm	3–4 (–5) mm long
Lateral teeth (2.5–) 3–4 (–5) mm	(3–) 4–5 (–6) mm	(4–) 5–6 (–8) mm long
Lowest tooth (3–) 4 (–6.5) mm	(3–) 5–6 (–7) mm	(5–) 6–7 (–11) mm long
Hairs black, brown, grey, white or mixed, thinning with age.	Hairs white or pale, always dense	Hairs always white and dense
Habitat		
Heavy soils	Sandy soils	Sands, often on dunes

pubescence (from mostly dark hairs in southeastern South Australia to pale or white hairs in northern parts of the range) and in flower size (generally increasing from south to north). Accommodated here are some tall plants, mostly from the Port Curtis district of Queensland, but erratically elsewhere, with atypical calyx form (the teeth unequal as in *P. patens* and *P. pallida*); these may also have larger leaflets with more pubescent upper surface, and one such was differentiated as *P. dietrichiae* Domin. Fig. 2.

Forms designated below as "atypical" display greater differences than those embraced above. Such forms are all cited and mapped with the same symbols, although they are atypical in different ways. The most common variation is in habit: stems may be single, but usually few to many, and of greatly varying heights. The Queensland University breeding experiments indicate genetic control of this variation, so that habit-variants "breed true" (I. de Lacy, pers. comm., cf. p. 130), and one variant which is many-stemmed has assumed significance in those experiments because of its economic potential. It has, perhaps unfortunately, been termed "semi-erect", but this term is not to be taken as indicating a heterozygous condition between prostrate and erect, but simply a particular variation from the tall, erect, typical form. However, a similar appearance at least is produced by grazing of tall, erect plants at an early stage, which merely delays the typical tall growth and induces formation of extra stems from the crown (J. Maconochie, pers. comm., from observations in Central Australia). In practice, many herbarium specimens do not allow certain evaluation of the habit represented, so that some of the citations as typical or atypical in this regard, are arbitrary. Even when an atypical "semi-erect" form is clearly indicated by specimen or label, it cannot be assumed that it will reproduce its own kind in different circumstances, though it appears that in Queensland many representatives of *P. australasica* are atypical in habit and, at the same time, true-breeding.

In a few localities in central Queensland (Warrego-Gregory South) a peculiar form appears: the leaflets have a narrow-elliptical outline with fewer and less apiculate denticulations. These plants have the erect stem and the inflorescence of *P. australasica*, but all have closely appressed, straight, ascending hairs on the stems. Such hairs are not seen elsewhere in the *P. patens* complex, but are characteristic of *P. cinerea*, a related but apparently quite distinct species which has nevertheless been confused with it in the past.

Three specimens from in or near the Musgrave Ranges (South Australia) present an atypical appearance: they have virtually no stem- or leaf-pubescence, so that prominent black glands are exposed. The calyx hairs are also very dark. This seems to be the form mentioned informally in the Burbidge manuscript as *P. australasica* "centralis", but in her treatment it is cited under *P. leucantha* and hybridism with the *P. patens* group is suspected. I have not been able to investigate further.

Finally there are a few specimens with floral and some inflorescence characters of *P. pallida*, or of *P. patens*, but with the vegetative characters of *P. australasica*, especially its habit—the flowers are long, with densely hairy calyx showing a long lowest lobe, the more or less continuous inflorescences of considerable length and with regularly spaced flowers; leaflets are glabrous or sparsely hairy above, and stems are erect or semi-erect. These cannot be unequivocally determined; they are mapped as 'X' (Fig. 1) and cited here: QUEENSLAND—**Gregory North**†: "Ardmore", 25 miles [40 km] W. of Dajarra, *Everist 3203*, 11.1947 (BRI); "Carandotta" Station, *Everist & Smith 161*, 2.1937 (BRI).—**Leichhardt**: roadside, Alpha-Emerald road, Drummond Ra., *Bisset 2*, 4.1957 (BRI). See also *P. pallida*.

† Subdivisions of the Australian States, used in citation of specimens, are derived from the following sources:—*Queensland:* Queensland Pastoral Districts, in McLean, R (ed.) 1886. 'The New Atlas of Australia . . .' (J. Sands: Sydney). *New South Wales:* map in Contr. New South Wales Natl. Herb. Fl. Ser. 1–8: 16 (1961). *Victoria:* grid system of Churchill, D. M. and A. de Corona, 1972. 'The Distribution of Victorian Plants . . .'. (Roy. Bot. Gard. & Natl. Herb. Victoria and Bot. Dept. Monash Univ.: Carlton, Victoria). *South Australia:* map inside back cover, *J. Adelaide Bot. Gard.* 1 (1), (1976) and subsequent issues. *Western Australia:* map by Beard, J. S., 1978 in J. Gentilli (ed.). 'Western Landscapes'. (Univ. of Western Australia Press: Perth). *Northern Territory:* map in Chippendale, G. M., 1971. 'Check list of Northern Territory Plants'. *Proc. Linn. Soc. New South Wales* 96: 209 (1971).

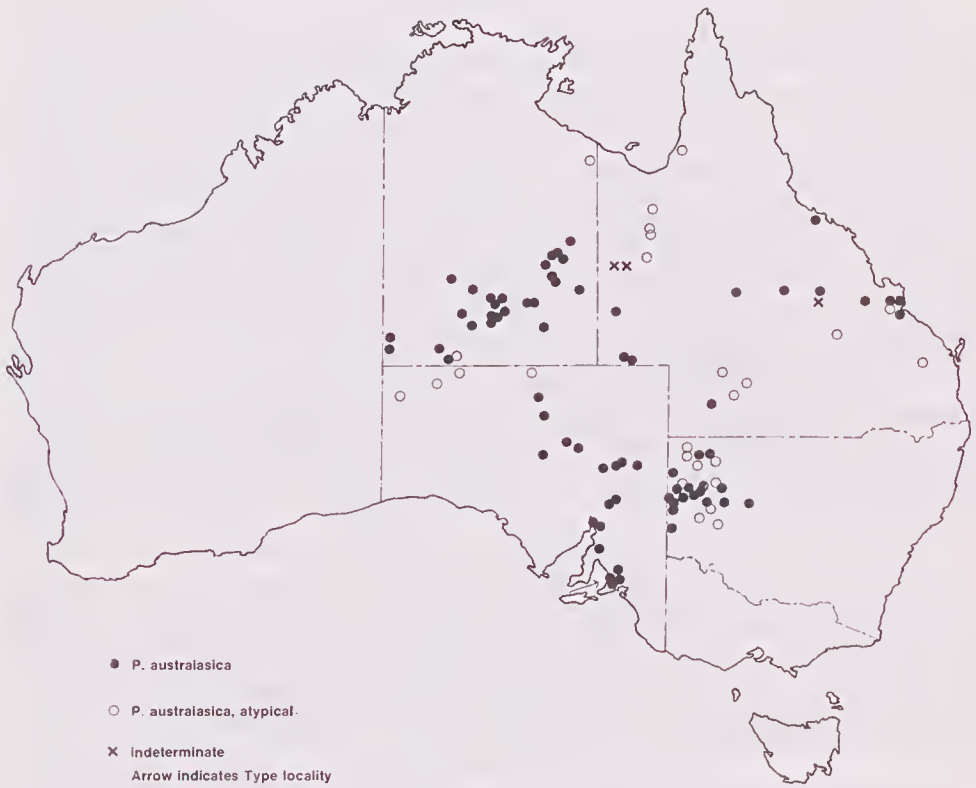

Fig. 1. Distribution of *P. australasica*.

DISTRIBUTION (see fig. 1): Queensland: Central Districts, reaching the coast near Rockhampton, and western Districts (with many occurrences atypical); far-western New South Wales (with many occurrences of "semi-erect plants); South Australia from the coast near Adelaide (mostly typical forms) to the Northern Territory: Central Australia (mostly typical, with rare atypical forms in that Division and near the Gulf of Carpentaria). Characteristically on heavy soils (or in Central Australia on the more alkaline soils), or in depressions; rarely on sandy soils but probably only when these overlie silts.

SPECIMENS EXAMINED (* indicates atypical form): QUEENSLAND: **Burke:** Gilbert R., *White 1339*, 2.1922 (BRI, NSW)*: Flinders R., *Plant 288*, 7.1891 (BRI)*; "Granada", *Bisset, Marriott & Sillar* 6.1957 (BRI)*, *do.*, 60 miles [97 km] NE. of Cloncurry, *Everist E 250*, 9.1962 (BRI)*; approx. 55 miles [88 km] SE. of Mt Isa, *Ollerenshaw PO 1247 & Kratzing*, 7.1974 (BRI)*. **North Kennedy:** Ayr, *Michael 1513* (BRI). **Gregory North:** Mulligan R., W. Queensland, *Clarke NSW 30677*, 2.1904 (NSW). **Mitchell:** 45 km E. of Aramac, *Beeston 140C*, 7.1975 (BRI); 30 miles [48 km] NNW. of Longreach, *Davidson 262*, 8.1952 (BRI). **Leichhardt:** Clermont, *White 3458*, 3.1927 (BRI); "Springwood" 20 miles [32 km] SW. of Rolleston, *Bisset E 209*, 12.1958 (BRI)*. **Port Curtis:** Wowan, Callide Valley, *Langford* 11.1972 (BRI); W. of Ridgelands . . ., 5–6 miles [c. 9 km] S. of Fitzroy R., *Speck 1805*, 10.1963 (BRI, NSW); Rockhampton, *Dietrich 697*, 2.1866 (NSW); 1/4 mile [0.4 km] from Kabra Siding . . ., *Bisset E 262*, 10.1959 (BRI)*: Keppel Bay, *Thozet NSW 30676* (NSW). **Burnett:** Brian Pastures, Gayndah, on lower slopes of Mt. Dube, *Schoneveld 131*, 8.1959 (BRI)*. **Gregory South:** "Yeppera" c. 50 miles [80 km] SSE. of Windorah, *Everist 7467*, 8.1963 (BRI)*; Birdsville, *Breen NSW 117277*, 7.1974 (NSW); 15 miles [24 km] S. of Birdsville, *Boyland 202*, 9.1966 (BRI); "Nockatunga", *Dorman NSW 117278*, 9.1967 (NSW). **Warrego:** "Lochabie", Quilpie, *Saunders* 11.1939 (BRI)*; 88 km SW. of Quilpie, *Silcock 428*, 7.1974 (BRI)*.

NEW SOUTH WALES: **North Far Western Plains:** 5-mile Bore, c. 19 km NW. of Milparinka, *Lee 244*, 9.1971 (NSW)*; 123 km W. of Wanaaring on Milparinka road, *Blaxell 616*, 11.1971 (NSW); Mt. Browne, *Corbett NSW 30669*, 9.1898 (NSW)*; "Coally" near Milparinka, *Richley*

1273, 10.1973 (NSW); "Yanеannia" Station, *Martensz CSIRO Div. Wildl. Res. 4120*, 12.1968 (NSW)*; 1 mile [1.6 km] S. of Palgamurtie Ck, on road to White Cliffs, *Lee 259*, 9.1971 (NSW)*; near Koonenberry Mtn (30° 31′ S, 142° 18′ E) . . ., *Lee 265*, 9.1971 (NSW); 5 km SE. of "Teilta" homestead, 30° 33′ S, 141° 15′ E, *Lee 207*, 9.1971 (NSW): "Tarella", Wilcannia–White Cliffs, *Quinn & Co. NSW 30658*, 10.1907 (NSW)*; Fowlers Gap [with various locality details], *Jacobs 2132*, 10.1975 (NSW)*, *Cunningham & Milthorpe 1027*, 9.1973 (NSW), *1368*, 8.1973 (NSW), *Thompson NSW 117276*, 7.1973 (NSW); Rock Hole Motel site . . ., 110 km NE. of Broken Hill, 31° 13′ S, 142° 17′ E, *Lee 266*, 9.1971 (NSW); "Rowena" Station c. 70 miles [c. 110 km] NE. of Broken Hill, *De Nardi 304*, 5.1969 (NSW); 68 km N. of Wilcannia on White Cliffs road, *Cunningham & Milthorpe 2954*, 10.1974 (NSW); 60 miles [100 km] S. from Wilcannia towards Cobar, *Martensz 67/117*, 4.1967 (NSW); 30 miles [48 km] W. of Wilcannia on Barrier Highway, *Newman 69*, 7.1962 (NSW): 36 miles [58 km] W. of Wilcannia, *Hobson NSW 30662*, 9.1949 (NSW)*; "Churinga", Broken Hill, *Milthorpe & Cunningham 1925*, 3.1974 (NSW); Black Bluff near Broken Hill, *Morris 661*, 8.1921 (NSW, BRI); Broken Hill, per *Farmers & Settlers Newspaper NSW 30657*, *30661*, 6.1934 (NSW), *Carne NSW 30660*, 6.1904 (NSW), *Morris 153*, 2.1920 (NSW, BRI). **South Far Western Plains**; Menindee, *Milthorpe 180*, 3.1973 (NSW)*; Boolaboolka Lake, 32° 35′ S, 143° 05′ E, *Milthorpe & Cunningham 2674*, 7.1974 (Soil Conservation Service, Condobolin)*; Harry Harry Ck, "Buckalow" Station, c. 62 miles [c. 100 km] SW. of Broken Hill, *Constable NSW 38481*, 7.1955 (NSW).

South Australia: **North-western Region**: Alalka [waterhole; vicinity of "Ernabella"], *Turvey NSW 86924*, 8.1968 (NSW)*; Mt Harriet, *Eichler 17266*, 9.1963 (NSW)*; Camp 22, Elder Exploring Expedition [c. 27° 00′ S, 129° 30′ E], *Helms NSW 30681*, *30689*, 7.1891 (NSW)*. **Lake Eyre Basin**: Xmas Bore S. of "Mt Dare" Station homestead, *Symon 3318*, 2.1965 (CANB)*; desert country towards Oodnadatta, *Fitzgerald NSW 30673*, 10.1920 (NSW); Edwards Creek railway siding, SSE. of Oodnadatta, *Briggs 1291*, 8.1967 (NSW); Strangways Springs, *Basedow 28*, 5.1920 (NSW); Lake Eyre, *Baldwin Spencer NSW 30691*, 9.1903 (NSW); between Old McDouall Peak & Twin Wells [c. 29° 50′ S, 135° 00′ E] *Basedow 61*, 4–5.1917 (NSW) **Flinders Ranges**: Farina c. 32 miles [c. 51 km] S. of Marree, *Briggs 4557*, 5.1972 (NSW); Mt Lyndhurst, *Koch 73*, 8.1898 (BRI), *Agric. Bureau S. Australia NSW 30674*, 1.1897 (NSW); tributary of Hookina R., 3 km NW. of Arkaba, 20 km NNE. of Hawker, *Ollerenshaw & Sikkes AS 695*, 9.1973 (NSW); Arkaba Ck, 10 miles [16 km] NNE. of Hawker, *Thompson NSW 117280*, 5.1969 (NSW). **Eastern Region**: c. 12 miles [c. 19 km] SSW. of "Moolawatana" homestead, 30° 00′ S, 139° 35′ E, *Briggs 4654*, 5.1972 (NSW). **Eyre Peninsula**: Mambray Ck road crossing, *Symon 4061*, 9.1966 (CANB). **Northern Lofty**: Germein Pass, *Burbidge & Gray 4081*, 9.1955 (CANB); towards Port Pirie from Crystal Brook, *Phillips 39*, 9.1973 (NSW). **Southern Lofty**: Morialta near Adelaide, *Cheel NSW 30682*, 8.1924 (NSW); Waterfall Gully, *Menzel NSW 30684*, 9.1896 (NSW); Brighton (sea coast), *Menzel* 3.1897 (BRI), *Menzel NSW 30692*, 5.1897 (NSW).

Northern Territory: **Darwin & Gulf District**: Settlement Creek, *Brass* 328, 5.1923 (BRI)*; Gulf of Carpentaria, *Watson NSW 30672*, 10.1918 (NSW). **Central Australia**: 14.5 km E. of "Tarlton Downs" homestead, 22° 40′ S, 136° 55′ E, *Maconochie 372*, 7.1967 (BRI): 35.3 miles [c. 57 km] E. of "Elkedra" homestead, *Chippendale NT 3139*, 10.1956 (NSW); 19 miles [31 km] NE. of "Ooratippra", *Swinbourne 578*, 11.1962 (NSW); 22 miles [35 km] NE. of "Ooratippra", *Perry 3447*, 3.1953 (BRI, CANB); 7.5 miles [12.5 km] W. of 13 Bore, Sandover Stock Route, *Chippendale NT 2524*, 8.1956 (NSW); Yuendumu, *McKee 8600*, 2.1960 (BRI); near "Lucy Creek" homestead, *Lazarides 5899*, 9.1956 (NSW, BRI); 2.5 miles [4 km] SW. of "Luey Creek" homestead, *Chippendale NT 3521*, 7.1957 (NSW, BRI); Old Tank crossing, "Marqua", *Chippendale NT 1787*, 10.1955 (NSW, BRI); Harry Creek . . . N. of Alice Springs, *Nelson 654*, 3.1963 (NSW), *Nelson 1497*, 5.1967 (NSW), *Swinbourne 441*, 9.1962 (NSW, CANB); 35 miles [56 km] from Plenty R. towards Harts Ra., *Gittins 1986*, 9.1969 (NSW, BRI); 23.4 miles [c. 38 km] E. of Harts Range Depot, *Chippendale NT 3169*, 10.1956 (NSW, CANB): Standley Chasm, 35 miles [56 km] W. of Alice Springs, *Chippendale NT 528*, 11.1954 (NSW, BRI); Standley Chasm, *Perry 5385*, 9.1955 (NSW, BRI, CANB); Stuart Highway c. 35 km SSW. of Alice Springs, *Lee 356*, 9.1978 (NSW): Telegraph Terrace, Alice Springs (cult., seed ex Harry Ck), *Nelson 1388*, 5.1965 (BRI); Alice Springs (cult., seed ex Harry Ck), *Swinbourne NT 11693*, 5.1965 (BRI): Heavitree Ra., 23° 40′ S, 133° 25′ E, *Gittins 2013*, 9.1969 (BRI, NSW); Serpentine Gorge, Macdonnell Ra., *Vickery NSW 117303*, 8.1960 (NSW); 2 miles [3 km] W. of Finke R. crossing near Hermannsburg, *Vasek 680914–44*, 9.1968 (CANB); Palm Valley, *Chippendale NT 2694*, 8.1956 (NSW); 7.8 miles [c. 13 km] SE. of Bottom Bore, Hale R., *Chippendale NT 4932*, 9.1958 (NSW, BRI); Docker Creek, *Chippendale NT 4566*, 6.1958 (NSW, BRI); Hull R., Petermann Ra., *Maconochie 1847*, 8.1973 (BRI): Ayers Rock, *Chippendale NT 673*, 11.1954 (NSW); "Mulga Park", 50 miles [80 km] N. of "Ernabella", *Turvey NSW 117279*, 6.1967 (NSW); "Mulga Park", 25° 57′ S, 131° 50′ E, *Henshall 172*, 4.1974 (NSW)*; Mann Ra., 30 miles [48 km] ENE. of Mt Davies Camp, *Dunlop 2004*, 10.1970 (NSW).

2. **P. patens** *Lindl.* in Mitchell, Three Exped. 2: 9 (1838). F. Mueller, Fragm. 3: 45 (1862). Holotype: Interior of New Holland, *Major Mitchell's Expedition 1836*, 19 March No. 2 (CGE !, photo NT !). Isotype, K ! (Herb. Hook., photo. CANB !); from Mitchell's text, this Type was collected at c. 33° 20′ S, 148° 40′ E, i.e. c. 35 km W. of Orange [New South Wales—Central Western Slopes].

Figs 2, 3. Fig. 2. *P. australasica:* 2a. stylized sketch to indicate erect habit and long, interrupted inflorescences, × ⅔. 2b. bud showing calyx with nearly equal teeth, × 7. Fig. 3. *P. patens* 3a. stylized sketch to indicate prostrate habit and short, continuous inflorescences , × ⅔. 3b. bud showing calyx with longer lowest lobe, × 7.

P. eriantha Benth. in Mitchell, Trop. Australia: 131 (1848); F. Mueller, Fragm. 3: 45 (1862) as syn. of *P. patens*; Bentham, Fl. Austral. 2: 192 (1864); F. M. Bailey, Queensland Fl. 2: 382 (1900)—inclusive of *P. pallida*; Beard, Descr. Cat. West Austral. Pl: 71 (1965). HOLOTYPE: 1846. 90 Ap. 16.46 [No. 90, 16 April 1846], a creeping plant; Balonne [as "Baloon"] R., Sub-Tropical New Holland. *Lieut.-Col. Sir T. L. Mitchell* (K). ISOTYPE, NSW! From Mitchell's text, this collection was made near St George [Queensland–Maranoa].

P. discolor Domin, Biblioth. Bot. 22(89²): 738 (1925). ISOSYNTYPE: 96. *J. Drummond*, S. W. Australia 1850 (K, n.v., photo. CANB!); cited as 'Sudwest Australien: Drummond 1850 No. 96'. ? ISOSYNTYPE (with attached field label "96"): Psoralea eriantha 5th. coll., "W. Australia 1849" (in ink on a pencilled label), Drummond no. 96 (NSW !).

[The name *P. patens* was misapplied by most Australian authors to *P. australasica* q.v., though their descriptions indicate that the two taxa treated here as species were not so distinguished by them, following Mueller in Fragm. 3: 45 (1862)].

[*P. eriantha* sensu auct. non Benth.: Tate (1890), and Domin (1925), misapplied this name to *P. pallida* q.v.]

Diagnostic characters as given in the Key and Table. *P. patens* shows a few general trends; there is also one quite common atypical form which is fairly uniform over a wide area of inland Australia.

Flowers tend to increase in size northwards in the main area of occurrence, i.e. in eastern Australia, and the calyx character (unequal teeth with the lowest longer than the others) becomes more marked in the longer flowers; there is perhaps a similar trend in the density of the inflorescence, also increasing northwards—the Holotype falls into the lower part of all these trends, and there is an overlap in dimensions with both *P. australasica* and *P. pallida*. An erect plant occurs rarely, with all other characters typical; since prostrateness is dominant this is to be expected (see p. 130). There is also an erratic occurrence of plants with smaller, to almost capitate, inflorescences; a number of them occur in Western Australia, where one was distinguished as *P. discolor* Domin. Fig. 3.

Several collections from inland areas are linked by one unusual feature. The plants of this atypical form have tomentose leaves giving them a greyish green appearance. Other characters are typical except that most of these specimens tend to have the shortest inflorescences in the species including some like those described for *P. discolor*. That "species", however, has leaves "altogether glabrous". Distribution maps for *P. patens* and *P. pallida* show that these atypical inland plants are virtually the only representatives of *P. patens* which occur sympatrically with *P. pallida*, and it is difficult not to infer interbreeding. Some, but not all, of them show broader leaflets with repand-denticulate margins also seen in *P. pallida*.

DISTRIBUTION (see fig. 4): the typical form occurs in all States except Tasmania, from the Type locality in the Central Western Slopes of New South Wales northwards into Queensland, where it is common in the Warrego and Maranoa Districts, and southwards into western Victoria. An atypical form with ± densely tomentose leaflets occurs in a broad NW–SE band from central Northern Territory across the Simpson Desert to western New South Wales, and there appear to be scattered occurrences of the typical form in South Australia, Western Australia and the Northern Territory (in the last two States the material examined probably does not show the distribution fully). The species is usually found on sandy soils but field botanists have reported that its sites tend to be favourable as to water content.

SPECIMENS EXAMINED (* indicates atypical form): QUEENSLAND: **Burke:** 10 miles [16 km] SE. of Doomadgee on road to Burketown, *Ollerenshaw PO 1352 & Kratzing*, 7.1974 (BRI). **Gregory North:** Georgina R., *Henry* 1889 (MEL). **South Kennedy:** Upper Belyando [R.], *Donaldson* 1890 (MEL); "Mentmore", Alpha, *McLaughlin*, 1.1955 (BRI). **Leichhardt:** 25 miles [40 km] SW. of Rolleston on "Springwood", *Wetherell 116*, 12.1964 (BRI). **Warrego:** Burenda [Downs], *Bailey* [as FMB] (BRI); "Akaray", Augathella, *Cull* 12.1961 (BRI); "Gowrie", Charleville, *Kerridge "specimen 3"*, 4.1958 (CANB), *Hart* 3.1956 (BRI), *do.*, c. 12 miles [c. 19 km] NE. of Charleville, *Everist 5909*, 11.1957 (CANB, BRI, NSW), *do.* 22 km NNE. of Charleville, *Smith 06111*, 11.1954 (BRI); Charleville, *Clemens* 10.1945 (BRI); Charleville, bed of Warrego R., *Michael 3036*, 5.1947 (BRI). **Maranoa:** "Lorne Downs" c. 70 miles [112 km] NW. of Mungalalla, *Martin* 1.1964 (BRI); between the Barcoo and the Roma, *Birch* 1871 (MEL); Roma, *Scortechini* (BRI); Maranoa, scr. *Mueller* 1885 (MEL); St. George, *Winn* 5.1894 (BRI); Thallon, *Cameron* 4.1940 (BRI). **Darling Downs:** near the Condamine River S. of Chinchilla, *Everist s.n.* 10.1951 (BRI); "Junabee", *Swann* 12.1972 (BRI).

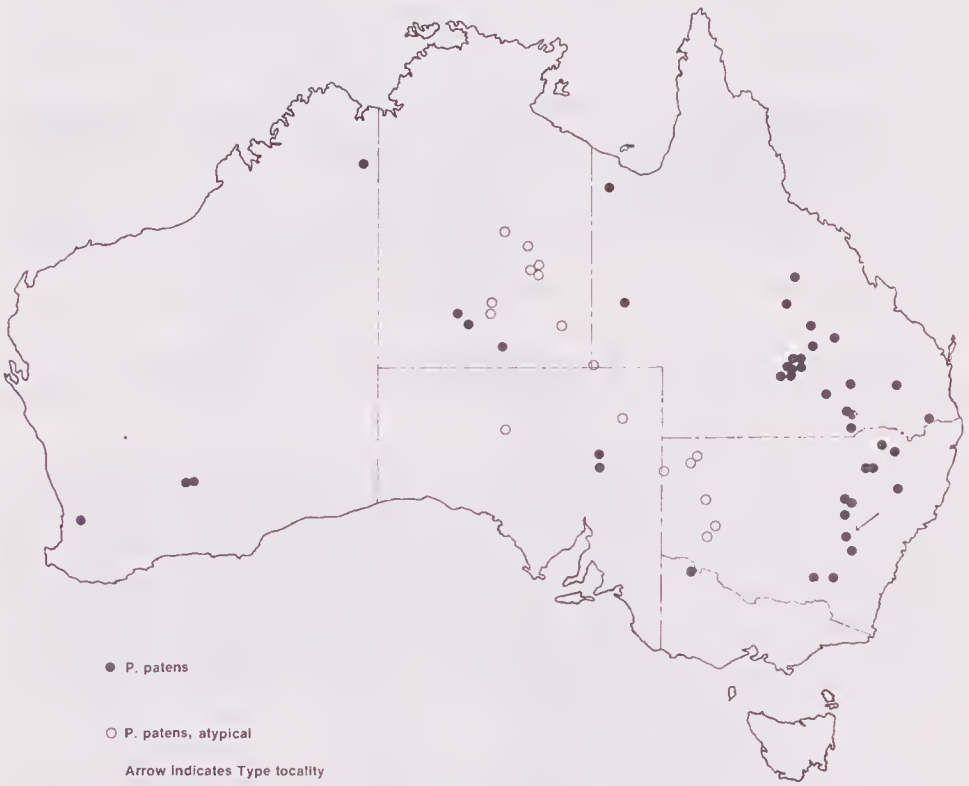

Fig. 4. Distribution of *P. patens*.

New South Wales: **North Western Slopes:** Crooble, *Williams 15*, 10.1951 (CANB); Warialda, *Rupp NSW 30819*, 1.1907 (NSW); Narrabri, *Breakwell NSW 30670*, 10.1912, NSW *30671*, 11.1912 (NSW); Howes Sheep Station, *Leichhardt* 4.1843—assuming vicinity Tamworth (NSW). **Central Western Slopes:** Gilgandra, *Cambage 1130*, 10.1904 (NSW); Dubbo, *Boorman NSW 30666*, 5.1900 (NSW); Wellington, *Bäuerlen 2855*, 1.1903, an erect plant (NSW); Cowra, *Tickner NSW 117289*, 5.1965 (NSW). **South Western Slopes:** Wagga Experiment Farm, *Ross NSW 30668*, 3.1920 (NSW); Gundagai, *Herd Master, Dept. Agric. NSW 30667*, 3.1918 (NSW). **Far Western Plains:** Cobham Lake, *Cunningham & Milthorpe 1066*, 9.1973 (NSW)*; roadside between Cobham Lake and the Salt Lake, *Lee 255*, 9.1971 (NSW)*; S. Australia border fence N. of "Brougham's Gate" 30° 30′ S, 141° 10′ E, *Lee 230*, 9.1971 (NSW)*; Old Woolshed Bore, 11 km SW. of "Moalie Park" towards Salisbury Downs, 29° 50′ S, 142° 47′ E, *Pickard 3042*, 10.1976 (NSW)*; Boolaboolka Lake, *Milthorpe & Cunningham 2674*, 8.1974 (NSW)*; 8 miles [13 km] W. of Pooncarie, Darling R., *Keast 7*, 9.1962 (NSW)*.

Victoria: **Region F:** Kooloonong, c. 45 miles [c. 73 km] NW. of Swan Hill, *Maefarlane* 11.1961 (NSW)*.

South Australia: **Lake Eyre Basin:** First Dunes of the Simpson Desert (presumably on Birdsville Track), *Symon 9391*, 9.1974 (NSW)*; Central South Australia, *Hillier 120*, . . . 1906 (BRI)*; Lake Eyre, *Hill 429*, 11.1955 (MEL); Hergot's [Hergott] Spring [Bore] [Marree], *Molineux* 1895 (MEL).

Western Australia: **South-Western Interzone–Coolgardie:** Coolgardie, *Webster NSW 30556*, 1900 (NSW).

Northern Territory: **Central Australia:** "Singleton", 240 miles [386 km] N. of Alice Springs, *Everist 4242*, 1.1950 (BRI)*; Burrabelly Waterhole, Frew R., 20° 52′ S, 135° 12′ E, *Dunlop 2503*, 2.1972 (BRI)*; 20 miles [32 km] NW. of "Ooratippra" Station, *Lazarides 6230*, 4.1957 (BRI, NSW, MEL)*; 44.9 miles [c. 71 km] E. of "Ammaroo" homestead, *Chippendale NT 3798*, 9.1957 (NSW, BRI)*; 7.5 miles [c. 12 km] W. of 13 Bore, Sandover Stock Route, *Chippendale NT 2525*, 8.1956 (NSW, BRI, MEL)*; 16-mile Ck., 18 miles [29 km] N. of Alice Springs, *Nelson 661*, 3.1963 (NSW)*; 19 miles [30 km] S. of Alice Springs, *Nelson 463*, 8.1962

(BRI)*; c. 3 miles [c. 5 km] N. of Gosses Bluff, *Chippendale NT 4152*, 4.1958 (BRI, MEL); 5 km S. of Hermannsburg, *Lee 367*, 9.1978 (NSW); Finke R., *Kempe 373*, 1881 (MEL); Northwestern Simpson Desert, 24° 09′ S, 136° 04′ E, *Henry 976*, 9.1973 (NSW)*; Poeppel Corner, 26° S, 138° E, *Boyland 286*, 9.1966 (BRI)*.

3. **P. pallida** *N. T. Burb.*, Telopea 2 (1): 127 (1980). HOLOTYPE: app. 22 miles [c. 35] south of Alice Springs, on railway line road, *N. T. Burbidge & M. Gray 4379*, 29.9.1955 (CANB !). ISOTYPES: CANB !, NSW (CANB 241933 !) and (to be sent to) K !, PERTH!

[*Psoralea eriantha* sensu auct., non Benth.: Tate, Hanb. Fl. Extratrop. South Australia: 69 (1980); Domin, Biblioth. Bot. 22 (89²): 738 (1925)].

["*Psoralea* sp. aff. *P. eriantha*", "*P.* sp. aff. *P. patens* sens. lat." and other similar *nomina nuda* have been applied to this species.]

Diagnostic characters as given in the Key and Table. *P. pallida* shows little variation beyond slight differences in flower and inflorescence dimensions, density of the white tomentum and spacing of flowers in the inflorescence. Rarely, but perhaps more often than is apparent, plants with other characters of *P. pallida* may have erect stems, but probably only weakly so. Allowance must be made for inaccurate use of terms used for habit, "ascending" and "erect" being interchanged, as well as "prostrate" and "decumbent". Most plants appear to have stems at first ascending (at c. 45°), then decumbent (prostrate with ascending tips) when their proximal parts drop to the ground. Another occasional variation not infrequent in *P. pallida* and seen only in an atypical form of *P. patens* among taxa of this complex, is shown by the leaflets. They are broader, more rounded, and more repand-denticulate on their margins. Fig. 5.

A few specimens from Central Queensland show flowers and inflorescences of *P. pallida* but leaves and habit of *P. australasica*, and cannot be unequivocally determined. They are cited and mapped with *P. australasica* above. Some reversal of this situation is seen in two specimens which are closer to *P. pallida* but show some characters of *P. australasica*. They are cited and mapped with *P. pallida* as atypical (*Perry 4076*, *Must 322*).

DISTRIBUTION (see fig. 6): common on sand dunes in the Simpson Desert and in all the surrounding States, reaching into the far southwest of New South Wales and across the Murray River into northwestern Victoria.

SPECIMENS EXAMINED (* indicates atypical form): QUEENSLAND: **Burke:** 33 miles [53 km] E. of Cloncurry township, *Perry 4076*, 9.1953 (NSW, BRI)*—very long inflorescences and in heavy grey soil. **Gregory North:** sand dune 54 km W. of "Glenormiston", *Purdie 1077*, 9.1977 (BRI); "Glenormiston", home paddock, *Colliver 38*, 8.1949 (BRI); Mulligan R., *Clarke NSW 30647*, 2.1904 (NSW); 25 miles [40 km] ESE [? SSE] of Bedourie, "Cluny" homestead, 24° 31′ S, 139° 36′ E, *Silcock S276*, 6.1970 (BRI); "Currawilla", 5-mile paddock, *Everist 3985*, 6.1949 (BRI). **Gregory South:** 38 miles [61 km] W. of Windorah, *Boyland 155*, 9.1966 (BRI); 10 miles [16 km] from Windorah towards "Currawilla" Station, *Gittins 1939*, 8.1969 (NSW); "South Galway", 45 miles [72 km] SW. of Windorah, *Everist 4038*, 6.1949 (BRI); Birdsville, *Everist & Smith 88*, 1.1937 (BRI); "Thylungra, c. 75 miles [121 km] NW of Quilpie, *Everist 5785A*, 10.1955 (BRI); 171.2 km NW. of "Noccundra", 26° 58′ S, 141° 06′ E, *Boyland 3109*, 7.1971 (BRI). **Warrego:** 23 miles [37 km] WNW. of Thargomindah, *Pedley 2473*, 9.1967 (BRI).

NEW SOUTH WALES: **North Far Western Plains:** 3.4 km W. of Fortville, Queensland–New South Wales border, 29° 00′ S, 141° 09′ E, *Pickard* 3175, 11.1976 (NSW); Queensland border between Warri Gate [House] and Fort Grey, *Richley 1506*, 12.1974 (NSW); Sturt Natl. Park, 29° 15′ S, 141° 45′ E, *Mulham W920*, 10.1976 (NSW); Solly Tank, near Fort Grey, *Dorman NSW 117296*, 9.1967 (NSW); "Yandama" (W. of Milparinka), *Richley* 1246, 10.1973 (NSW); c. 2 miles [c. 3 km] S. from Cobham Lake, *Lee 258*, 9.1971 (NSW); Paldrumatta Bore, *Corbett NSW 30652*, 10.1901 (NSW); Cobham sandhills, *Morris 788*, 10.1921 (NSW, BRI); Cobham mailbox, *Cunningham & Milthorpe 1044*, 9.1973 (NSW); "Cobham" 30° 18′ S, 142° 07′ E, *Lawrie 1558*, 7.1974 (NSW); "Teilta" Station, 116 km NNW of Broken Hill, 30° 50′ S, 141° 14′ E, *Lee 217*, 9.1971 (NSW); Tilpa, *Turner NSW 30656*, 4.1916 (NSW); between Tilpa & Barnato, *McReaddie NSW 117295*, 5.1967 (NSW); "Nelyambo", 20 miles [32 km] NE. of Wilcannia . . . *Werner (388)*, 11.1969 (NSW). **South Far Western Plains:** "Wirryilka" c. 70 miles [c. 113 km] SE. of Broken Hill, *Milthorpe 679*, 3.1972 (NSW); "Kinchega" Natl. Park, Menindee, *Ryan & Everly NSW 130141*, 6.1969 (NSW); . . . 4 km E. of Menindee, *Sikkes 1273*, 9.1973 (NSW); Menindee, *Johnson 709*, 9.1946 (NSW), *Richley 1336*, 10.1973 (NSW); "Willottia" Station, via

Fig. 5. *P. pallida:* 5a. stylized sketch to indicate ascending habit and continuous inflorescences, × ⅔. 5b. bud showing calyx with long lowest lobe, × 5. 5c. leaf with repand-denticulate margins, × ⅔.

Fig. 6. Distribution of *P. pallida*.

Menindee, *Cautello NSW 117297*, 1.1956 (NSW); 79 miles [127 km] S. of Broken Hill, *Leigh W54*, 10.1966 (NSW); "Garston" Station via Wentworth, *Cullinan NSW 117294*, 5.1963 (NSW); Wentworth–Poonearie, *Constable NSW 4567*, 10.1947 (NSW); between Euston & Gol Gol, *Vickery NSW 30655*, 10.1949 (NSW).

VICTORIA: **Region A:** Hattah Lakes National Park, *Beauglehole 39184 & Willis*, 10.1960 (MEL), *Beauglehole 1026*, 10.1948 (MEL), *Beauglehole 39183*, 10.1960 (MEL); near Hattah Lakes Natl. Park, *Cunningham & Milthorpe 3622*, 12.1978 (NSW); Mildura, *Willis*, 5.1937 (MEL); Kings Billabong, between Mildura and Red Cliffs, *Heushall* 11.1965 (MEL). **Region G:** Woorinen, c. 6–7 miles [c. 10–11 km] WNW. of Swan Hill, per *Irwin*, 6.1969 (MEL).

SOUTH AUSTRALIA: **Lake Eyre Basin:** Brady's Waterhole near "Cordillo Downs", *Basedow 60*, 10.1919 (NSW); Strzeleeki Track, *Milthorpe & Cunningham 3030*, 10.1974 (NSW); Mt Kingston [? Old Bore], *Macd. Stuart* (MEL); . . . 38 miles [61 km] E. of Dalhousie Springs, *Lothian 1660*, 8.1963 (MEL); Blinman, per *Tepper* 1890 'No. 1439' (MEL).

NORTHERN TERRITORY: **Central Australia:** 19.6 miles [c. 32 km] S. of Alice Springs, *Chippendale NT 9613*, 10.1962 (CANB); c. 65 km S. of Alice Springs, *Lee 372*, 10.1978 (NSW); Northwestern Simpson Desert, *Henry 935*, 9.1973 (NSW); 2 miles [3 km] N. of Bundooma Siding, *Swinbourne 417*, 8.1962 (NSW); 6.5 miles [10.4 km] N. of Horseshoe Bend, *Chippendale NT 3913*, 10.1957 (NSW); Charlotte Waters, *Byrne 1887* (MEL), *Selwartz* 1889 (MEL); 17 miles [23 km] NW. of "Andado" homestead, *Must 322*, 8.1968 (BRI)*—leaves very sparsely pubescent; Poeppel Corner 26° S, 138° E, *Boyland 278*, 9.1966 (BRI).

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SHORT COMMUNICATIONS

Compsopogon coeruleus (Balbis) Montagne (Rhodophyta: Erythrotrichiaceae). New record of this genus for Australia.

Samples of this alga were first collected in Australia by A. Pringle (5. 1977); it was then growing attached to mangrove roots in the Lane Cove River, which flows into Port Jackson, New South Wales. The collection site is on a bank opposite Redbank Oval. At the same site the alga was present in small numbers in October 1977, but formed large, coarse green mats in November 1977.

Further samples of this species were obtained from Hexham Swamps, northwest of Newcastle, N.S.W. on 13.12.1978, by W. McGregor.

Dr Dominic Cheng (pers. comm.) has also found *Compsopogon* in the Nepean River, just downstream of the old Camden Water Pollution Control Plant discharge.

According to Thaxter (1900) this genus characteristically occurs in fresh water, but may occur in tidal water that is practically fresh. This description also applies to the locations cited from Australia. Smith (1950) records that in Arizona *C. coeruleus* may grow in such profusion in irrigation ditches as to be a nuisance.

Regarding the species of this genus Thaxter (1900) says "few of them appear to be distinguished by characters that might not be included in the variation of a single species". I take a similar view in regarding *C. oishii* Okamura (Okamura 1915) as being a synonym of *C. coeruleus*.

Fritsch (1945, p. 438) states that *Compsopogon* is widely distributed, and he considers, as do Colley (in Collins 1916) and Smith (1950), that its distribution is likely to have been extended owing to its introduction by shipping or by the importing of plants. This view is supported by the relatively recent report of this genus from New Zealand (Chapman and Cameron, (1967)) and particularly by the report by Zaneveld et al. (1976) of the occurrence of this species in an aquarium in Czechoslovakia. The latter paper also cites earlier records of the genus in aquaria in Germany.

C. coeruleus has been recorded from Algeria, Japan, the Antilles, Sumatra, and the U.S.A. as far north as Woods Hole, Massachusetts, (Collins 1916, De Toni 1924, Okamura 1915, Smith 1950) but the genus does not appear to have been recorded previously from Australia.

The cited specimens are preserved at the National Herbarium of N.S.W. (NSW).

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Valerie MAY

National Herbarium of New South Wales,
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